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COUNTRY USSR

REPORT

SUBJECT English Translation of MIG-21F-13 Aircraft Manual Entitled Instructions No. GK-021B, Book I, Part II

DATE DISTR. August 1963

NO. PAGES 2

REFERENCES

DATE OF INFO.

PLACE & DATE ACQ

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English translation of a Soviet manual on the MIG-21F-13 /FISHBED/ aircraft entitled Instructions No. GK-021B, Book I, Part II

The translation 50X1-HUM begins with page 316 of Part II and includes Chapters VI through XIII which concern, respectively, the take-off and landing systems, the pressurized cockpit, the cockpit canopy, the ejection seat, the fire-fighting equipment, rigging the aircraft, dismantling and assembly, and regulation maintenance of the aircraft. 50X1-HUM

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CHAPTER VI [P 316]

TAKEOFF AND LANDING SYSTEMS

1. GENERAL INFORMATION

The takeoff and landing systems of the aircraft permit takeoff and landing from both concrete VPP [Vzletno-Posadochnaya Polosa -- airstrip] and dirt airstrips.

The takeoff and landing systems consist of the landing gear, tires, and a parabrake.

Landing Gear

The landing gear of the aircraft is of the tricycle type which retracts in flight. The main landing gear struts (Figs. 57 and 59) are equipped with 600x200V-size, KT-82M wheels with pneumatic disk brakes and are attached to the right and left wings.

In flight the main gear struts retract into the wings, and the wheels, after turning relative to the struts, retract into the fuselage.

The nose gear strut (Figs. 57 and 59) is equipped with a 500x180A-size, KT-38 wheel having two pneumatic chamber-type brakes and is attached in the nose section of the fuselage to frame No 6.

The nose gear strut and wheel retract forward into the fuselage.

In the extended position the main gear struts are held by the

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drag struts and cylinders with circular mechanical locks and by hydraulic locks, and the nose gear strut, by a mechanical and a hydraulic lock.

In the retracted position all three gears are held by mechanical [P 321] locks (Figs. 60 and 61).

Retraction and extension of the gears are actuated by a hydraulic system; emergency extension is performed by an emergency pneumatic system. If necessary, the nose gear can be extended separately by an independent emergency system for this purpose (special handle and cable linkage which opens the uplock). Extension of the nose gear from the well in the fuselage in this case occurs under the action of the weight of the gear itself and the slipstream.

The shocks of all three of the gears are of the nitrogen-hydraulic type with positive reciprocal action and are located within the struts.

The upper cylinder chambers of the main gear struts are used as reservoir bottles for the pneumatic system.

The nose gear is equipped with the following (Fig 59):

a) A mechanism located within the strut for returning the wheel to neutral position. In taxiing, when the shock is compressed, this mechanism is disengaged and the wheel is free to turn.

b) A non-linear linkage to the vibrashock which permits large angular displacements of the vibrashock guide with deflections of the wheel to angles up to ±15° from the neutral position (angles at which [p 324]

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"shimmy" could appear), thereby facilitating prevention of "shimmy" and small angular displacements of the vibrashock guide with large angular deflections of the wheel up to ±47°. This in turn facilitates taxiing of the aircraft since in this case practically no work is expended on the damper.

c) A vibration damper (vibrashock) designed for preventing development of inattenuable vibrations ("shimmy") of the nose gear wheel during takeoff and landing of the aircraft (Fig. 76).

The vibrashock has a compensating chamber which feeds AMG-10 fluid to the working chambers of the damper in the event of leakage and compensates for temperature expansion.

On the coupling rod there are graduation lines for checking filling of the vibrashock with AMG-10 fluid. When the white graduation line on the rod lines up with the surface of the upper cover of the compensating chamber, this corresponds to normal filling of the vibrashock with AMG-10 fluid at $t = +20 \pm 10°$ C.

The red graduation line on the rod corresponds to a low fluid level. The vibrashock will function normally to the low fluid level line.

The main gear strut is equipped with the following (Fig. 62):

a) A mechanism for turning the half axle of the main gear. [p 326]

b) A hydraulic gear-actuating cylinder with a mechanical downlock (Fig. 63).

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[P

Basic Technical Specifications of the Landing Gear [P 326]

No	Item	Main gear	Nose gear
1	Type of shock absorber	N_2-hydraulic	N_2-hydraulic
2	Working fluid used in shocks	AMG-10 GOST 6794-53	AMG-10 GOST 6794-53
3	Full travel of shock	280^{+2}_{-3} mm	90^{+2}_{-1} mm
4	Size and type of wheels	600x200V (KT-82M)	500x180A (KT-38)
5	Initial pressure of N_2 in the shock:		
	a) at normal takeoff weight	30±1 kg/cm^2	34±1 kg/cm^2
	b) at maximum takeoff weight	30±1 kg/cm^2	34±1 kg/cm^2
6	Tire pressure:		[P 328]
	a) at normal takeoff weight	8+0.5 kg/cm^2	6+0.5 kg/cm^2
	b) at maximum takeoff weight	10+0.5 kg/cm^2	6+0.5 kg/cm^2
7	Tire compression:		
	a) at normal takeoff weight	40 mm	25 mm
	b) at maximum takeoff weight	45 mm	30 mm

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NOTE:

1. For measurement of shock strut compression, see Figs. 64 and 65.

2. Operation of aircraft at temperatures above +30° C is accompanied by a rise of pressure in the landing gear tires, therefore (under such conditions), it is necessary to check their pressure and drop it to the values indicated in Item No 7 of the Basic Technical Specifications of the Landing Gear.

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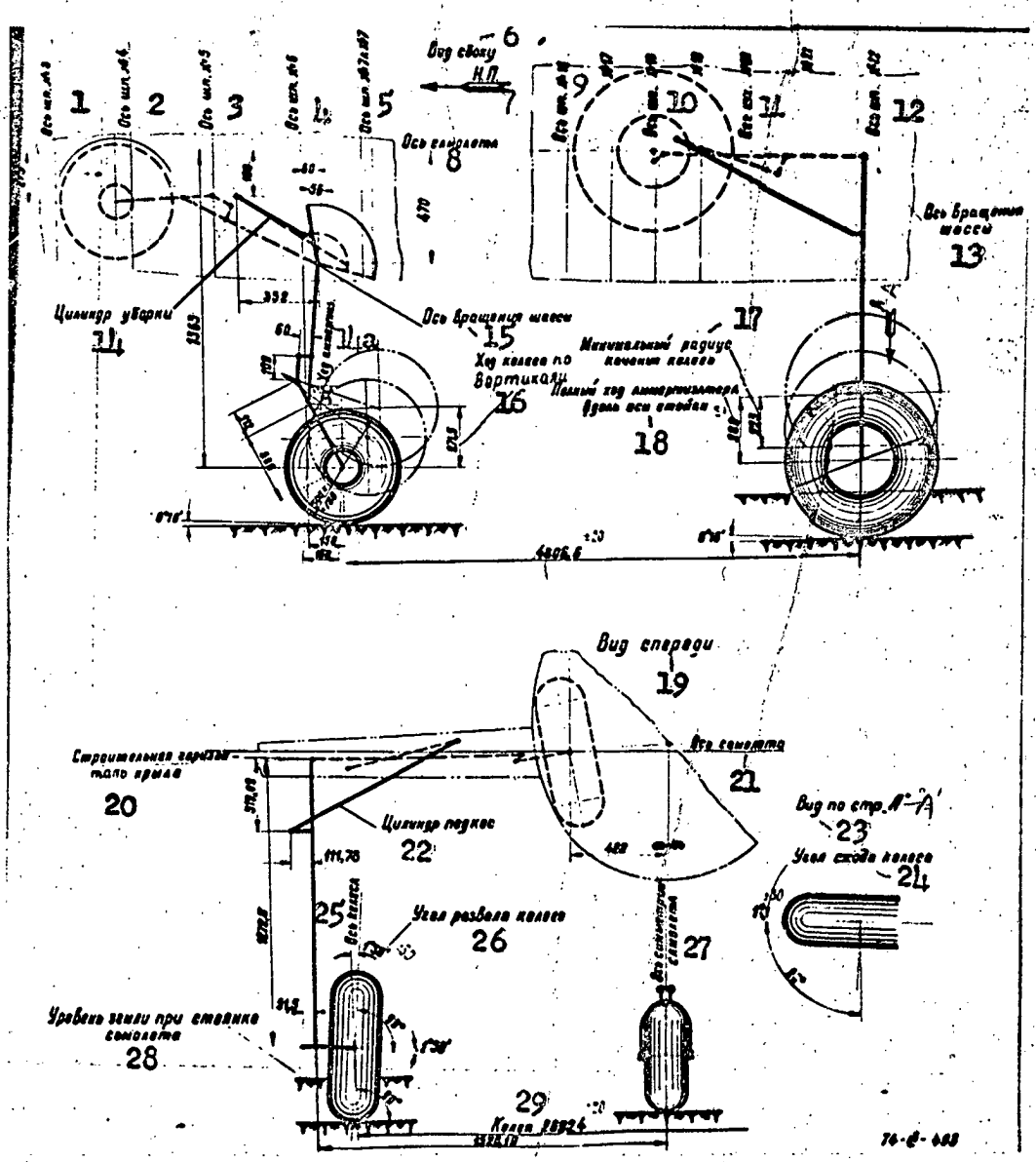


Fig. 57. Geometric diagram of the landing gear.

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[Captions to numbers on Fig. 57 on preceding page.] [P 317]

1 to 5 - Axes of frames Nos 3 to 7
6 - Side view
7 - NP [Napravleniye poleta -- "line of flight" or forward]
8 - Axis of aircraft
9 - Axis of frame No 16
10 - " " " No 18
11 - " " " No 20
12 - " " " No 22
13 - Landing gear pivot axis
14 - Actuating cylinder
14a - Shock strut travel
15 - Landing gear pivot axis
16 - Vertical travel of wheel
17 - Minimum radius of revolution of wheel [tire compression limit]
18 - Full travel of shock along strut axis
19 - Front view
20 - Wing center-plane line
21 - Axis of aircraft
22 - Actuating cylinder
23 - View along arrow A
24 - Toe-in angle of wheel
25 - Axis of wheel
26 - Camber angle of wheel
27 - Axis of symmetry of aircraft
28 - Ground level of parked aircraft
29 - Track width

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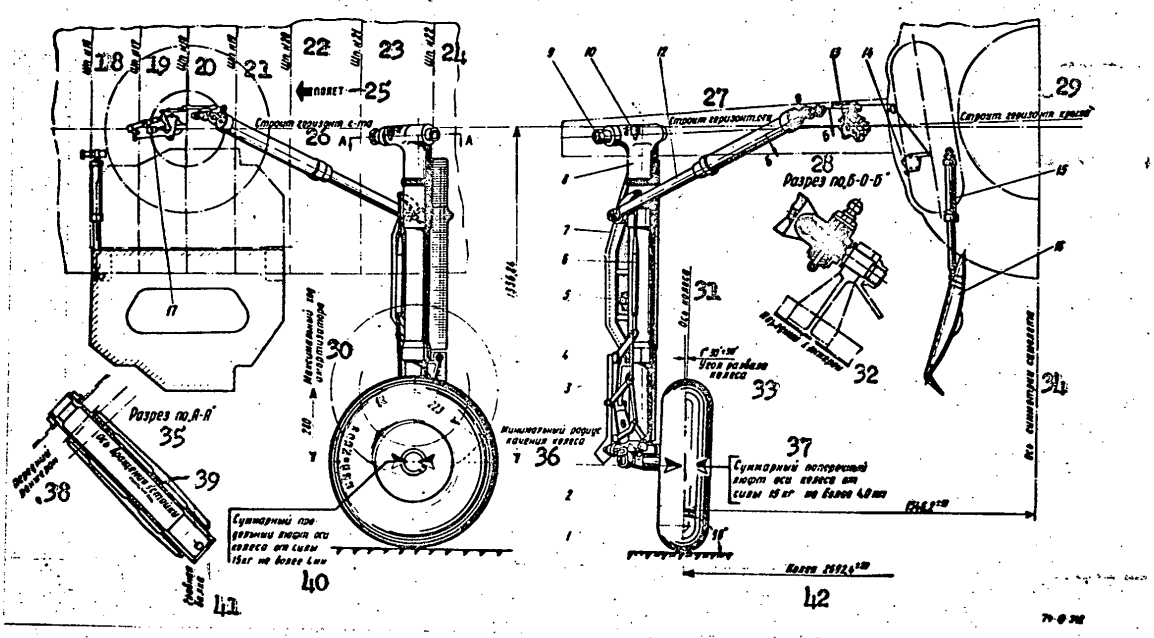


Fig. 58. Main landing gear installation.

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Fig. 58. Main landing gear system. [Diagram on preceding page.] [p 319]

1 - KT-82M wheel
2 - Bracket for engaging gear to lock [in RETRACTED position]
3 - Parallel mechanism for pivoting wheel with half axle
4 - Torsion link door
5 - External indicator light
6 - Tie rod of wheel pivoting mechanism
7 - Strut door
8 - Landing gear strut
9 - Landing gear pivoting axis
10 - Limit switch for electrical signaling of EXTENDED position of landing gear
11 - [not used]
12 - Landing gear actuating cylinder
13 - Landing gear uplock
14 - Wheel well door lock
15 - Wheel well door actuator
16 - Wheel well door
17 - Limit switch for signaling RETRACTED position of landing gear
18 to 24 - Frames No 16 to 22
25 - Forward
26, 27 - Horizontal construction line of aircraft
28 - Cross section along *B-O-B*
29 - Wing center-plane line
30 - Maximum travel of shock
31 - Axis of wheel
32 - Front spar
33 - Camber angle of wheel
34 - Axis of symmetry of aircraft
35 - Cross section along A-A
36 - Minimum radius of revolution of wheel [tire compression limit]
37 - Total transverse play of wheel axle from force of 15 kg should not exceed 40 mm
38 - Front spar
39 - Strut pivot axis
40 - Total end play of wheel axle from force of 15 kg should not exceed 4 mm
41 - Main spar
42 - Track width

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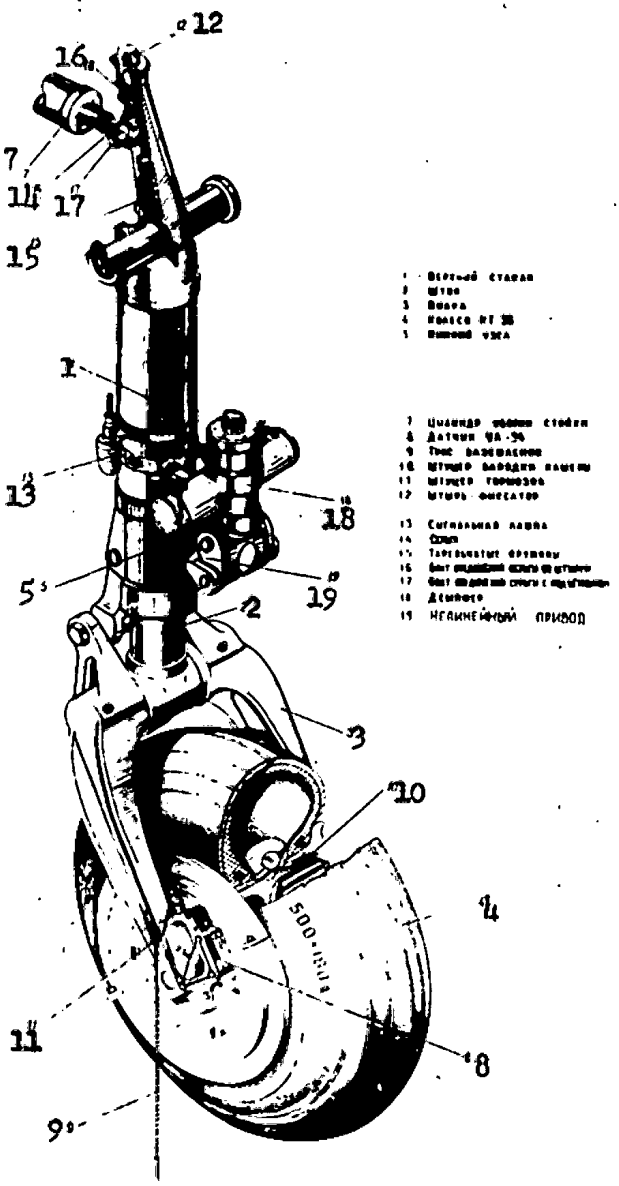


Fig. 59. Nose landing gear

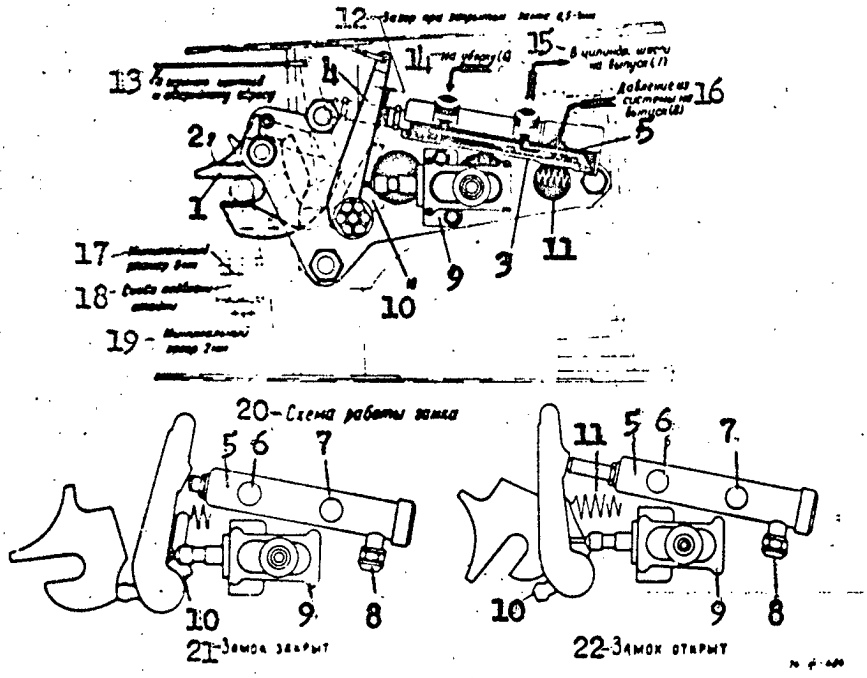
1 - Upper strut cylinder
2 - Rod
3 - Fork
4 - KT-38 wheel
5 - Lower unit
6 - [not used]
7 - Gear actuating cylinder
8 - UA-[?]4 sensing unit
9 - Grounding cable
10 - Tire filler connection
11 - Brake line connection
12 - Pin
13 - Indicator light
14 - Stirrup
15 - Dished-disk springs
16 - Bolt for fastening stirrup to shaft
17 - Bolt for fastening stirrup to actuator
18 - Vibrashock
19 - Non-linear drive

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1. Крюк
2. Пружина крюка
3. Корпус замка
4. Рычаг
5. Гидроцилиндр замка
6. Штуцер подвода давления на уборку
7. Штуцер подвода давления на выпуск к гидроцилиндру
8. Штуцер подвода давления на выпуск
9. Концевой выключатель
10. Кулачок
11. Пружина кулачка

Fig. 60. Main landing gear uplock.

1. Hook
2. Hook spring
3. Lock housing
4. Arm
5. Lock hydraulic cylinder
6. Tube connection for supplying pressure for retraction
7. Tube connection for supplying pressure to the hydraulic cylinder for extension
8. Tube connection for supplying pressure for extension
9. Terminal switch
10. Pawl
11. Pawl spring
12. Clearance with lock closed, 0.5-1 mm
13. [first line illegible] and emergency release
14. In retraction (6)
15. To the gear actuating cylinder in extension
16. Pressure from the system in extension (8)
17. Minimum clearance, 6 mm
18. Strut suspension bracket retainer
19. Minimum clearance, 2 mm
20. Lock operating diagram
21. Lock closed
22. Lock open

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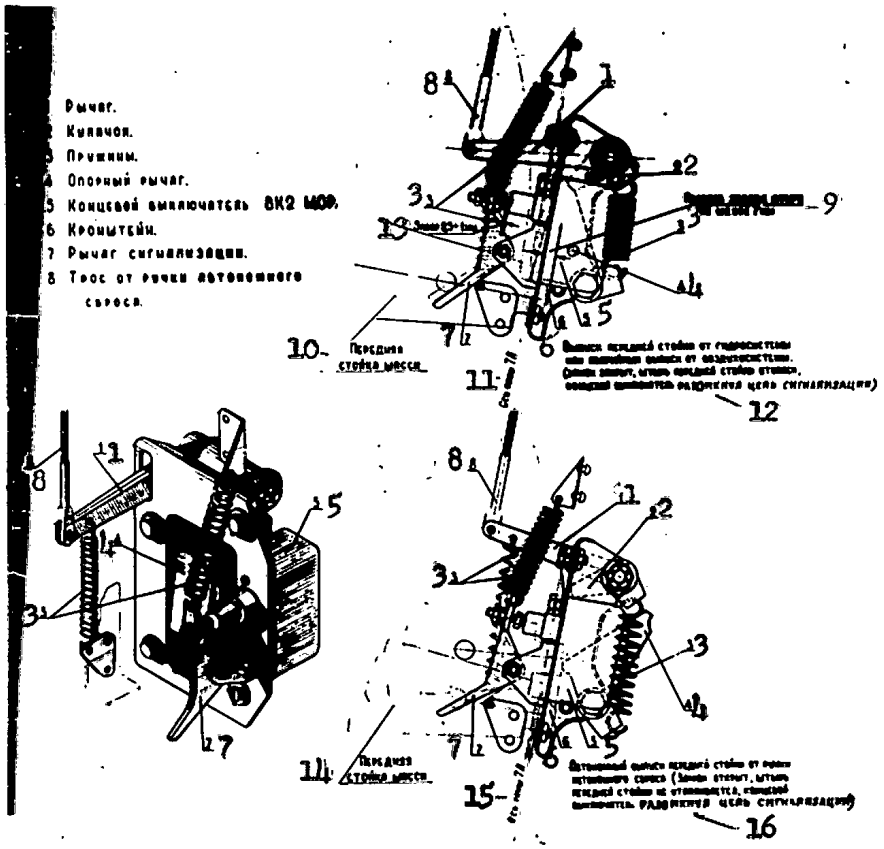


Fig. 61. Nose gear uplock.

1 - Lever
2 - Detainer
3 - Springs
4 - Support lever
5 - VK2 14OR limit switch
6 - Holder
7 - Signal lever
8 - Cable from nose-gear-only release handle
9 - Pin clearance of not less than 7 mm
10 - Nose gear strut
11 - Axis of frame
12 - Extension of nose gear by the hydraulic system, or emergency estension by the pneumatic system (lock is closed, nose strut pin is contained, signal circuit has been opened by the limit switch)
13 - Clearance, 0.5-1 mm
15 - Axis of frame
16 - Independent release of nose gear by the nose-gear-only release handle (lock is open, nose strut pin is free, signal circuit has been opened by the limit switch)

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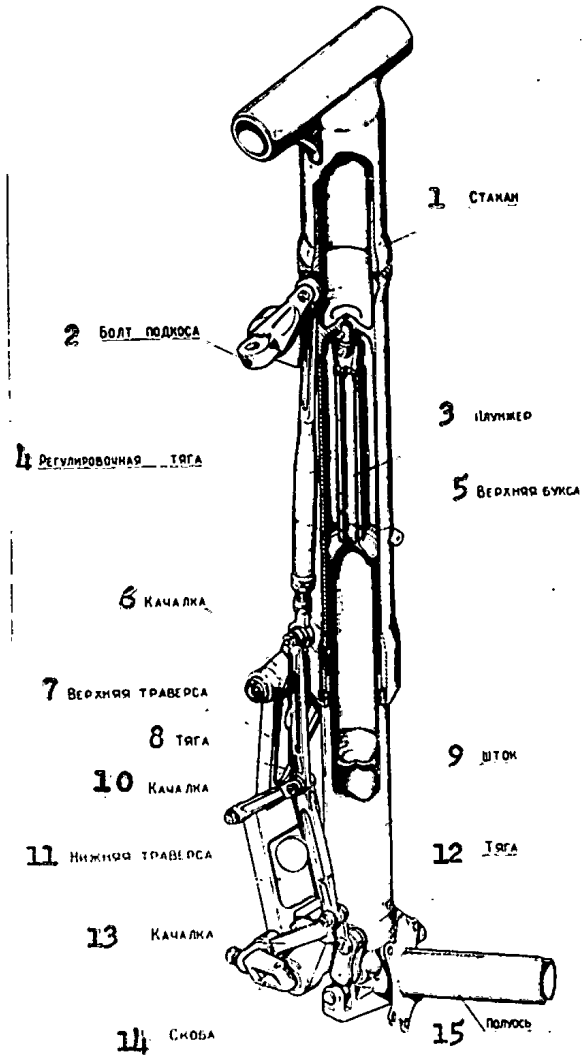


Fig. 62. Main gear strut.

1 - Cylinder [p 326]
2 - Drag strut bolt
3 - Plunger
4 - Control rod
5 - Upper chamber
6 - Rocker arm
7 - Upper crossarm
8 - Push-pull rod
9 - Strut
10 - Rocker arm
11 - Lower crossarm
12 - Push-pull rod
13 - Rocker arm
14 - Bracket
15 - Half axle

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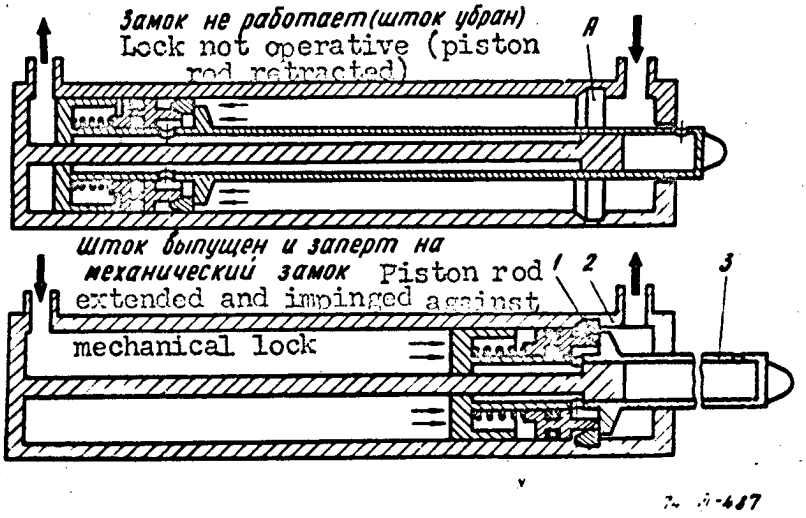


Fig. 63. Diagram showing operation of the mechanical lock of the main landing gear actuator cylinder.

1 - Ring spring
2 - Hydraulic cylinder
3 - Piston rod
4 - Lock seat

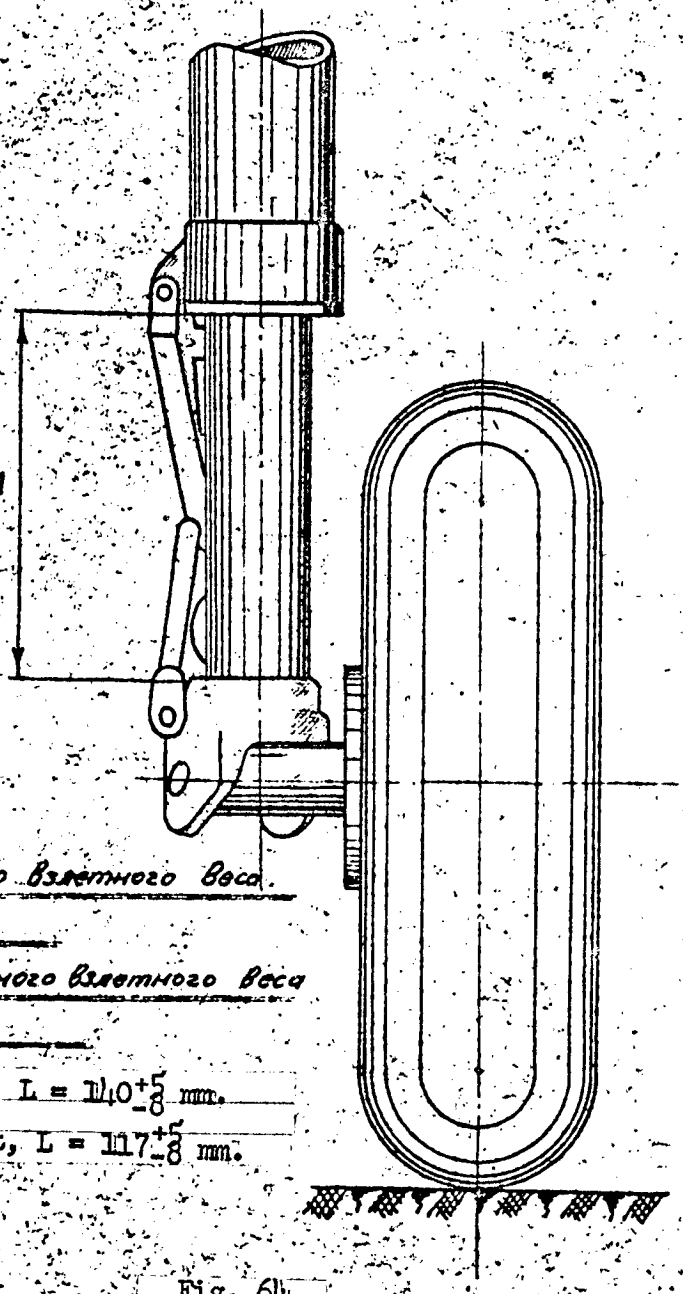
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[p 329]

Compression of the main gear shock of aircraft in a parked position.

Стояночная просадка амортизатора основной стойки шасси



1 Для нормального взлетного веса.
L = 140$^{+5}_{-8}$ мм

2 Для максимального взлетного веса
L = 117$^{+5}_{-8}$ мм

1. For normal takeoff weight, L = 140$^{+5}_{-8}$ mm.
2. For maximum takeoff weight, L = 117$^{+5}_{-8}$ mm.

Fig. 64
Фиг. № 64

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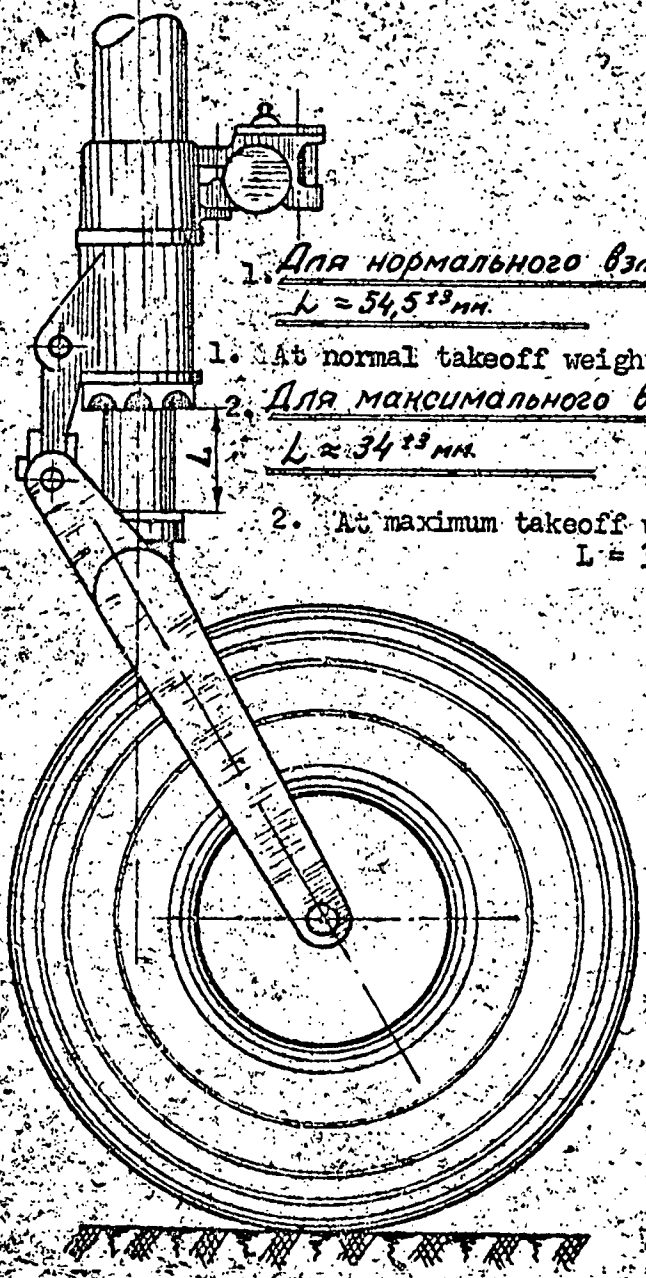
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[p 330]

Compression of the nose gear shock of aircraft in a parked position.

Стояночная просадка амортизатора носовой стойки шасси



1. Для нормального взлетного веса $L \approx 54{,}5^{\pm 3}$ мм.

1. At normal takeoff weight, L = $54.5^{\pm 3}$ mm.

2. Для максимального взлетного веса $L \approx 34^{\pm 3}$ мм.

2. At maximum takeoff weight, L = $34^{\pm 3}$ mm.

Fig. 65

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Flaps [P 328]

Flaps are installed on the aircraft to shorten the takeoff run and lower the landing speed.

The flaps have two positions: RETRACTED and EXTENDED. Flap control is electro-hydraulic (Figs. 66 and 67). The flaps are held in the RETRACTED position by ball check locks in the hydraulic cylinders and by the pressure of the working fluid; they are held in the EXTENDED position by the pressure of the working fluid.

In the EXTENDED position, with increase of speed the flaps force the working fluid "out" of the hydraulic cylinders under the action of the velocity-pressure whereby the angle of deflection of the flaps is decreased.

The flaps should begin to retract at a speed of Vpr = 340 km/ hr. [P 331] At such a speed the force acting on the flap surfaces due to the velocity-pressure is insufficient to overcome the force from the hydraulic cylinders, therefore constant pressure is supplied from the hydraulic system through the GA-185 valve to the connecting tube of the cylinders to retract the flaps.

This makes it possible to initiate flap retraction at speeds of Vpr = 340 km/hr and up.

Thus the GA-185 valve supplies fluid only for extending the flaps but it also returns it during flap retraction. The connecting tube of

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the pressure line "for retraction" is closed at the valve. Flap exten- [P 331]
sion is accomplished as a result of the difference between the areas of the pistons of the cylinder for extension and retraction, i.e. due to the larger area of the piston in the volume of the cylinder for extension.

In the cockpit of the aircraft, on the left console panel, there is a two-position "M3-1" mechanism for controlling the flaps.

This mechanism has two flap positions: "RETRACT" and "EXTEND". Extension and retraction of the flaps is accomplished by depressing the appropriate button. The "M3-1" mechanism does not have a signal light. Flap position is checked by the indicator light on the PPS-2 panel in the cockpit.

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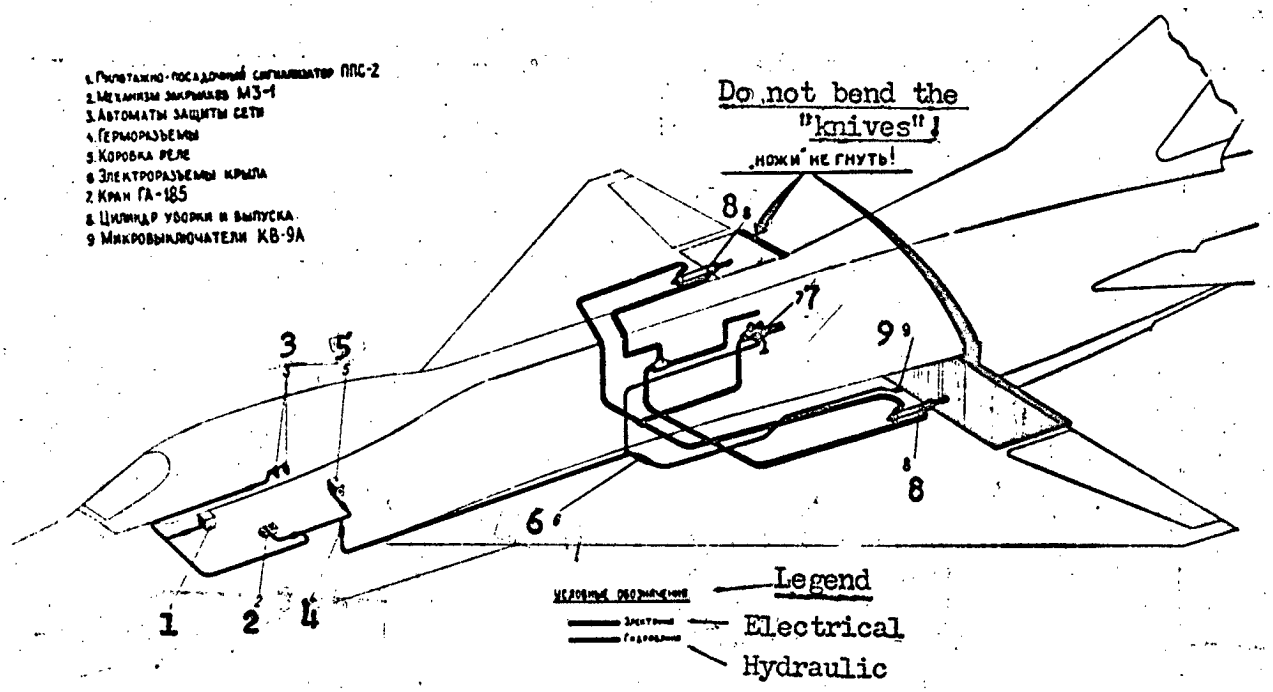


Fig. 66. Flap control system

1. Landing gear and flap indicator PPS-2
2. M3-1 flap mechanism
3. Circuit breakers
4. Airtight connectors
5. Relay box
6. Wing electrical connectors
7. GA-185 valve
8. Actuator cylinder
9. KV-9A microswitch

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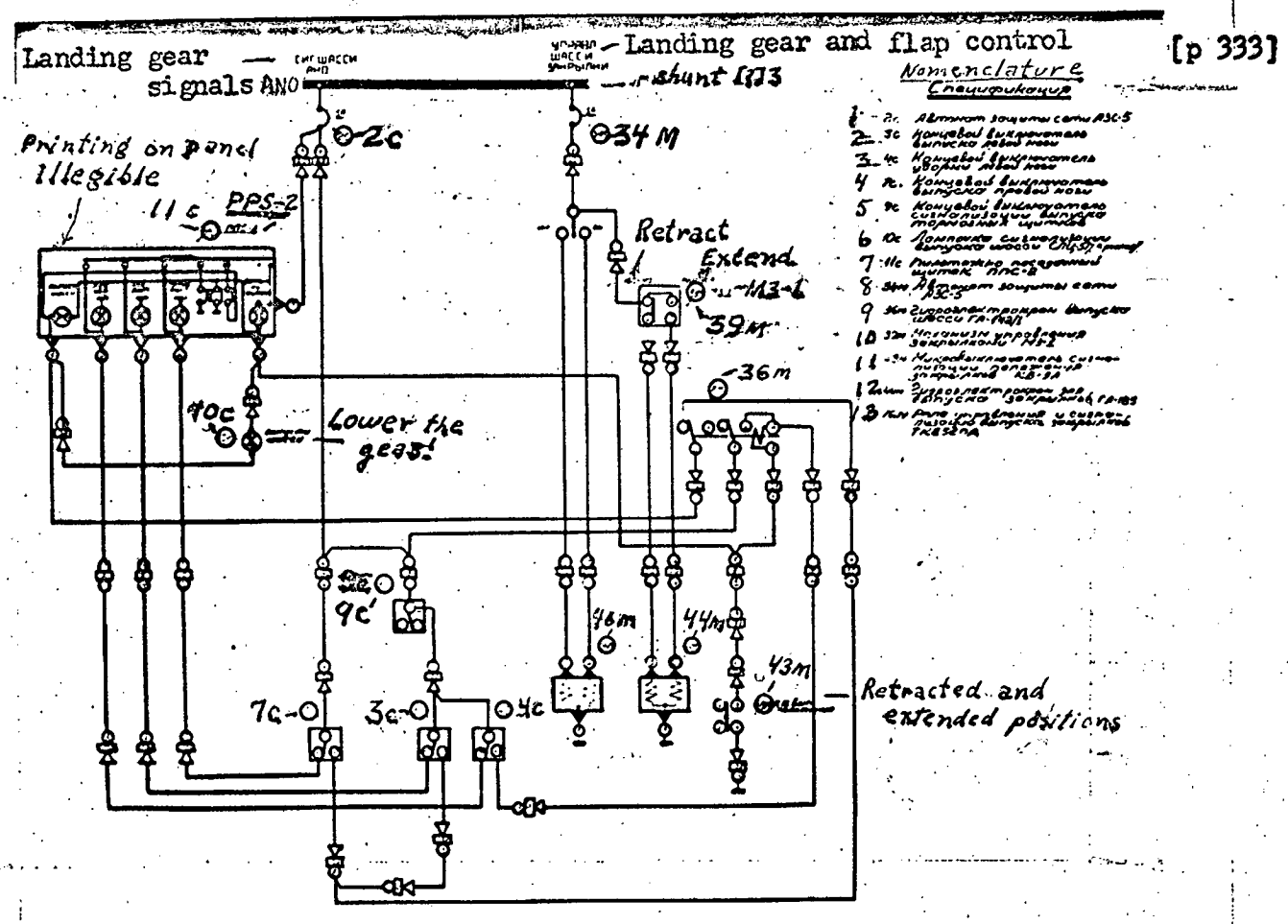


Fig. 67. Flap and landing gear electrical control diagram.

1. 2c - AZS-5 circuit breaker
2. 3c - Nose gear down limit switch
3. 4c - Left landing gear up limit switch
4. 7c - Right landing gear down limit switch
5. 9c - Speed brake down limit signaling switch
6. 10c - SPTs-51 landing gear warning light (red)
7. 11c - Landing gear and flap indicator panel PPS-2
8. 34M - AZS-5 circuit breaker
9. 36M - GA-142/1 hydraulic-electric landing gear extension valve
10. 39M - M3-1 flap control mechanism
11. 43M - KV-9A flap position indicator microswitch
12. 44M - GA-185 hydraulic-electric flap extension valve
13. 46M - TKB52PD [?] flap extension control and signal relay

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The Parabrake [p 334]

In order to shorten the landing run, use is made of a PT-6152-59-type landing parachute (or the later, PT-21-type series).

Packing of the parabrake in its deployment bag is done by a specialist of the parachute service in accordance with instructions No 2010-59 (in accordance with No 3145-61 for the PT-21-type) on a special bench. Then the container with the parachute and cable is stowed in the parabrake compartment of the aircraft and the doors are closed.

The doors are fastened by a lock and safetyed with M2-K1-type lockwire.

The cable of the parabrake is fitted in the clamps (spring clips) on the ventral fin of the tail section of the fuselage. One end of the cable is fastened by means of a clevis to the eye ring of the parachute shroud lines and the other, to a connecting link, which in turn is fastened to the parachute attach- lock in the tail of the fuselage by means of a stirrup (see Figs. 78 and 81).

When using the PT-21-type parabrake, the following must be observed:

1. Normal speed when deploying the parachute, 250-280 km/hr.
2. Maximum speed when deploying the parachute, not above 300 km/hr. [P 335]
3. In a case when the parachute is deployed at a speed above 300 km/hr it is necessary to replace the parabrake, cable and connecting link.

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4. The number of times the same PT-21-type parabrake can be used is guaranteed according to the following table on the basis of the speed at which it is deployed during landing of the aircraft.

Speed	Number of deployments	Remarks
300 km/hr	one time	Maximum permissible speed
290 km/hr	two times	Single permissible speed
280 km/hr	10 times	Highest operational speed
250-260 km/hr	20 times	Average operational speed

The parachute service must do the following: gather up the parachute from the runway immediately after the aircraft has turned off to park and, having put it in a packing bag, transport it to the special room and prepare it for the next flight in accordance with instructions No 2145-61 on the use of a PT-21-type parachute.

2. RETRACTION AND EXTENSION OF THE LANDING GEAR (Fig. 68) [P 336]

Checking of landing gear retraction and extension on the ground is performed in the following order:

1. Raise the aircraft with jacks until the wheels clear the ground.
2. Plug in the external electric power source.
3. Hook up the external hydraulic pump.

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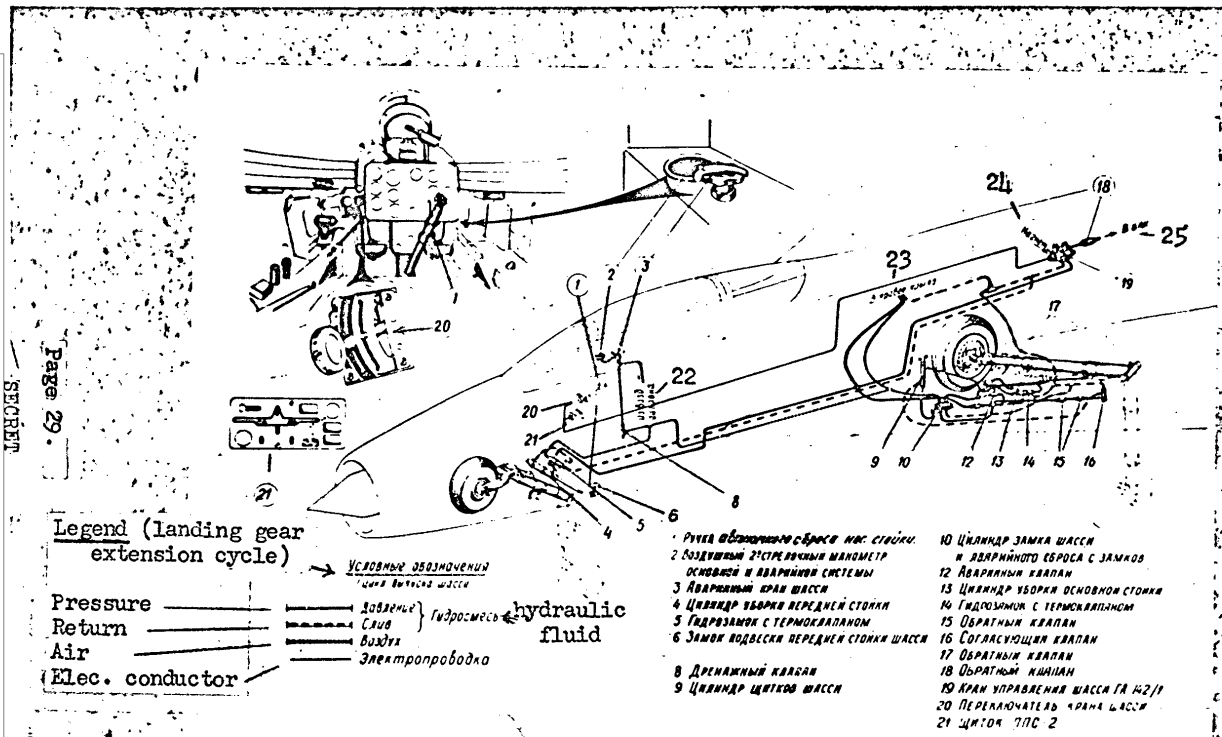
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Фиг. 68. Управление шасси.

Fig. 68. Landing gear control.

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[Captions to Fig. 68 on preceding page.] [P 337]

1 - Nose gear emergency extension handle
2 - Double-pointer manometer of the main and emergency pneumatic systems
3 - Landing gear emergency valve
4 - Nose gear actuator cylinder
5 - Hydraulic lock with thermovalve [sic]
6 - Nose gear uplock
7 - [not used]
8 - Dump valve
9 - Landing gear door cylinder
10 - Landing gear lock and emergency extension cylinder
11 - [not used]
12 - Emergency
13 - Main landing gear actuator cylinder
14 - Hydraulic lock with thermovalve
15 - Return valve [Check valve]
16 - Sequence valve
17 - Return valve
18 - Return valve
19 - GA-142/1 landing gear control valve
20 - Landing gear valve switch
21 - PPS-2 panel [Pilotazhno-Posadochnyy Signalizator -- landing gear, flap and speed brake indicator panel]
22 - from the compressed air bottle
23 - To the right wing
24 - Pump
25 - To the reservoir

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4. Build up working pressure in the main hydraulic system.

5. Set the lever of the landing gear [selector] switch first "For Extension" and then in the "RETRACTED" position. 10-15 seconds after the red landing gear warning lights go on, move the switch lever to the neutral position and lock it.

6. Set the lever of the landing gear switch in the "EXTENDED" position. 10-15 seconds after the green landing gear indicator lights go on, move the switch lever to the neutral position and lock it.

Extension of the nose landing gear can also be verified by the appearance of the mechanical nose gear indicator.

NOTE: During a landing the landing gear switch lever should remain in the "EXTENDED" gear position. This switch should remain in this position until the aircraft has been taxiied to the parking apron, after which it should be set in the neutral position and locked

7. Lower the aircraft back down on its wheels and remove the jacks.

WARNING: The external hydraulic pump should not be disconnected until at least one minute after the landing gear valve has been set in the "EXTENDED" gear position and the green landing gear indicator light has come on. After this, switch the landing gear valve to the neutral position and then lower the aircraft with the jacks. Under these conditions the strut will be engaged by the mechanical downlock. [p 338]

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8. CHECKING THE SERVICEABILITY OF THE LANDING GEAR

When conducting an examination of the landing gear, the following should be checked:

1. Carefully examine the welded joints on the struts and units of the landing gear with a magnifying glass, paying particular attention to the joint finish and the area of transition from joint to parent metal.

Prior to examination, the joints should be cleaned of dust and dirt and washed with gasoline. If any cracks are found, the strut or the unit of the landing gear should be removed from the aircraft and sent to repair.

2. The total play at the axis of a wheel from a force of 15 kg applied to the axis in the longitudinal and transverse directions should be as follows:

- for the main landing gears, not more than 8 mm in the longitudinal and transverse directions;

- for the nose landing gear, not more than 5 mm in both directions.

3. With the main and nose landing gears in the extended position, [P 339] the play in the main landing gear wheel door, measured at its end in the direction of its rotation should not exceed 12 mm under a force of 2-3 kg.

(play in the doors which are firmly fastened to the struts is not permissible)

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[p 340]

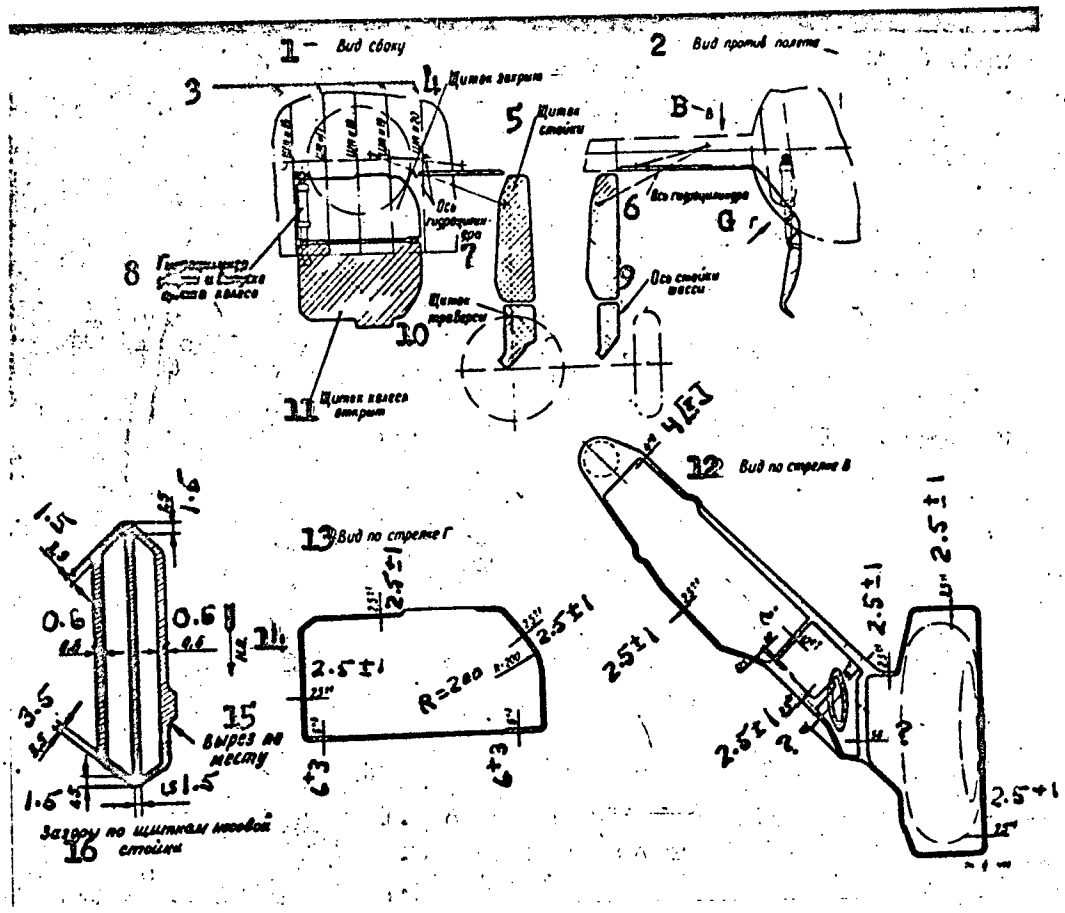


Fig. 69. Diagram showing clearances between the doors and wing elements and fuselage.

1 - Side view
2 - Rear view
3 - Frames Nos 16 to 20 [left to right]
4 - Door closed
5 - Strut door
6 - Axis of the hydraulic cylinder
7 - " " " " "
8 - Door hydraulic actuator cylinder
9 - Axis of gear strut
10 - Door has been turned
11 - Wheel door open
12 - View along arrow B
13 - View along arrow G
14 - Forward
15 - Cut-out
16 - Clearances along nose gear doors

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of the

Play in the nose wheel door measured at its end in the direction of rotation must not exceed 7 mm upon application of a force of 2-3 kg to the end of the door.

4. In the retracted position (valve lever in "Neutral" position), the surfaces of the doors must line up with the contours of the wing and fuselage. Clearances between the doors and the wing and fuselage wells must correspond to the values indicated in Fig. 69.

NOTE: In operation, because of hinge joint wear and permanent strut deformation, the amount of clearance along the aft edges of the main strut doors could decrease to 3 mm. A clearance of less than 3 mm is evidence of large permanent deformations of the main landing gear struts caused by rough landings at high speeds. In this case (if the clearance is less than 3 mm) the struts must be replaced. Filing the door along its aft edge and the edge of the skin around the wing opening to achieve the proper clearance is prohibited.

5. Tire pressure is measured when the aircraft is in a parked position, and the pressure in the shocks, when the aircraft has been raised on jacks.

6. Check for shifting of a tire on its rim by means of the red check lines on the tire and wheel rim. If the marks have shifted, check the condition of the inner tube and air valve. [p 341]

7. Axial play in the hinge joints is permissible within the tolerance limits which provide free rotation without binding.

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4. Charging and Topping the Landing Gear Shocks

General

Raise the aircraft by the nose and wing jacks until the wheels are clear of the ground.

Connect the charging apparatus to the strut filler valve.

Drop nitrogen pressure in shocks to zero.

Keep shocks immobile for 2-2 1/2 hours to drain off the AMG-10 oil.

A. Nose Strut

1. Unscrew the filler valve and bleed plug of the nose shock (Fig. 70) and add about 100 cm^3 of AMG-10 oil (total volume of AMG-10 oil in the shock, about 650 cm^3) through the opening in the strut using a squirt can.

2. Smoothly lower the nose of the aircraft until the nose gear [p343] shock is fully compressed.

Adjust the jack so that the strut is vertical when the shock is fully compressed. The excess AMG-10 oil will flow from the shock through the filler valve opening.

Hold in this compressed position for 20 min to ensure complete bleed off of excess AMG-10 oil. If no AMG-10 oil comes out, fill the shock with oil again and bleed of the excess in the sequence indicated above.

3. Screw in the filler valve and bleed plug, raise the nose of the aircraft until the wheel is free of the ground and fill the shock using the device with industrial nitrogen to a pressure of 34 ± 1 kg/cm^2.

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B. Main Struts

1. Unscrew the filler valve of the main gear shocks (Fig. 71) and add about 100 cm^3 of AMG-10 oil (total oil capacity of each shock is about 2,400 cm^3) to each shock through the strut openings using a squirt can.

2. Smoothly lower the aircraft by the wing jacks until the main strut shocks are fully compressed.

Adjust the jacks so that the struts are vertical when the shocks are fully compressed. The excess AMG-10 will flow from the shocks through the filler valve opening.

Hold in this compressed position for 20 min for complete bleed off [p 345] of excess AMG-10 oil. If no oil comes out, fill the shocks with oil again and bleed off the excess in the sequence indicated above.

3. Screw in the filler valve, raise the aircraft by the wing jacks until the wheels are clear and fill the shocks, using the equipment, with industrial nitrogen to a pressure of 30 ± 1 kg/cm^2.

4. Lower aircraft on wheels.

NOTE: 1. If the shocks are charged in a warm place in the winter time, it must be taken into consideration that with a decrease in the temperature of the ambient air there will be a decrease in the pressure in the shocks.

In this case it is necessary to increase the pressure of the charge by a value equal to 4 kg/cm^2 for each 10° C of difference between the indoor and outdoor temperatures.

2. When changing hydraulic fluid in the strut shocks it is necessary to remove the struts from the aircraft.

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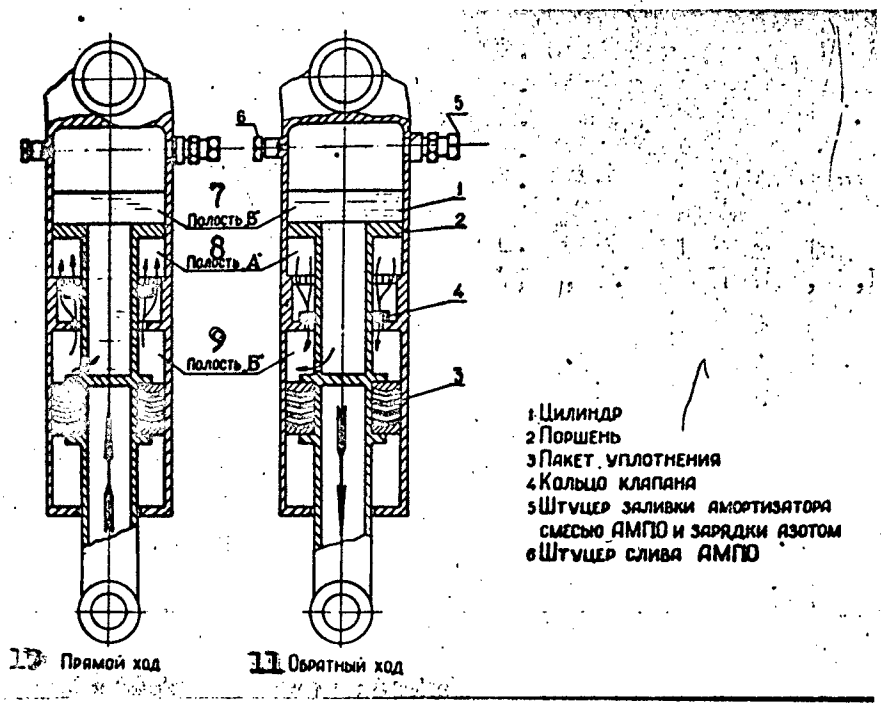


Fig. 70. Diagram showing hydraulic fluid flow during operation of the nose gear shock strut.

1 - Cylinder
2 - Piston
3 - Packing
4 - Valve ring
5 - Connection for filling the shock with AMG-10 fluid and charging with nitrogen
6 - Drain connection
7 - Chamber B
8 - Chamber A
9 - Chamber Б
10 - Upstroke
11 - Downstroke

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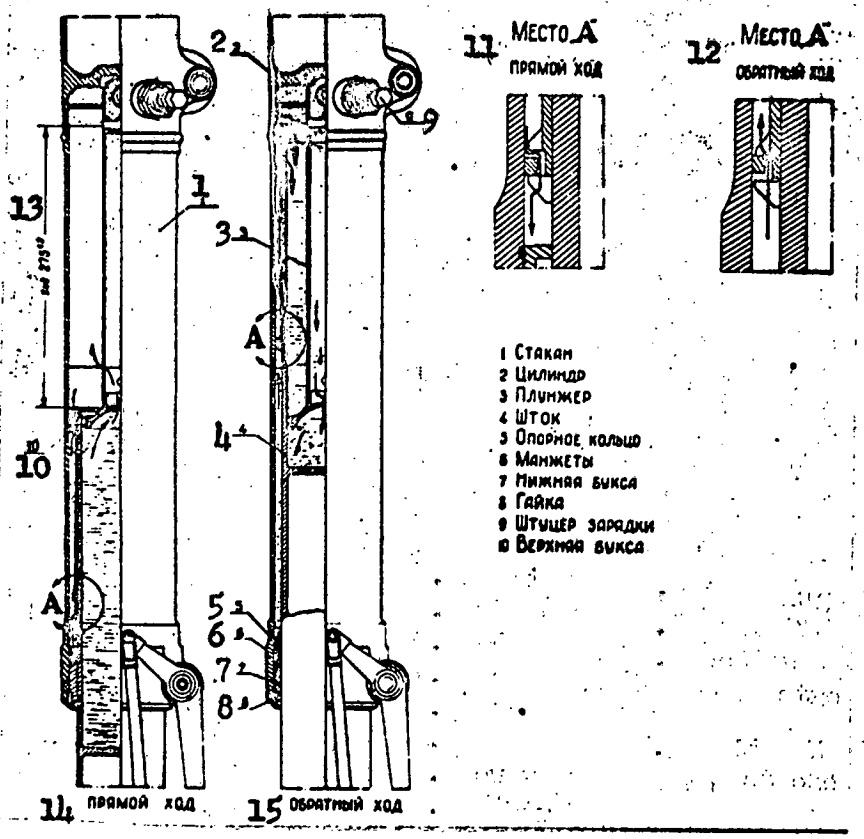


Fig. 71. Diagram showing operation of the main landing gear shocks.

1 - Cylinder
2 - Cylinder
3 - Plunger
4 - Rod
5 - Thrust ring
6 - Sleeves
7 - Lower bushing
8 - Nut
9 - Filler connection
10 - Upper bushing
11 - Location A - upstroke
12 - Location A - upstroke
13 - Travel, 275±2
14 - Upstroke
15 - Downstroke

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5. OPERATION OF LANDING GEAR WHEELS [P 346]

Landing gear wheel operation requires the following:

1. When one-sided wear appears on the main landing gear wheel tires full wear must not be allowed to occur but the tires should be removed from wheels and remounted in the opposite position.

Landing gear tires can be used until the tread wears down to the cord.

2. The brakes should be inspected after every 3-months of aircraft operation. When inspecting the brakes of KT-82M-typewheels, the following should be observed:

a) Any number of fine cracks and also annular scores up to 0.5 mm deep in the cast iron layer on the working surfaces of the bi-metallic sectors of the brake discs are permissible.

b) Development of cracks throughout the width of a sector and extending throughout the cast iron layer to the steel carrier is not permissible. With the formation of such cracks, even though in only one sector, the disk should be replaced with a new one.

c) An unlimited number of cracks in the metalloceramic /powder metal/ layer of the metalloceramic disks, the pressure plate and on the face of the carrier which is coated with metalloceramic are permissible.

d) Cracks going through the metalloceramic layer and the carrier are not permissible.

e) Any warping of the bimetallic and metallic disks which does not [P 347] cause the wheels to drag with the brake released is permissible.

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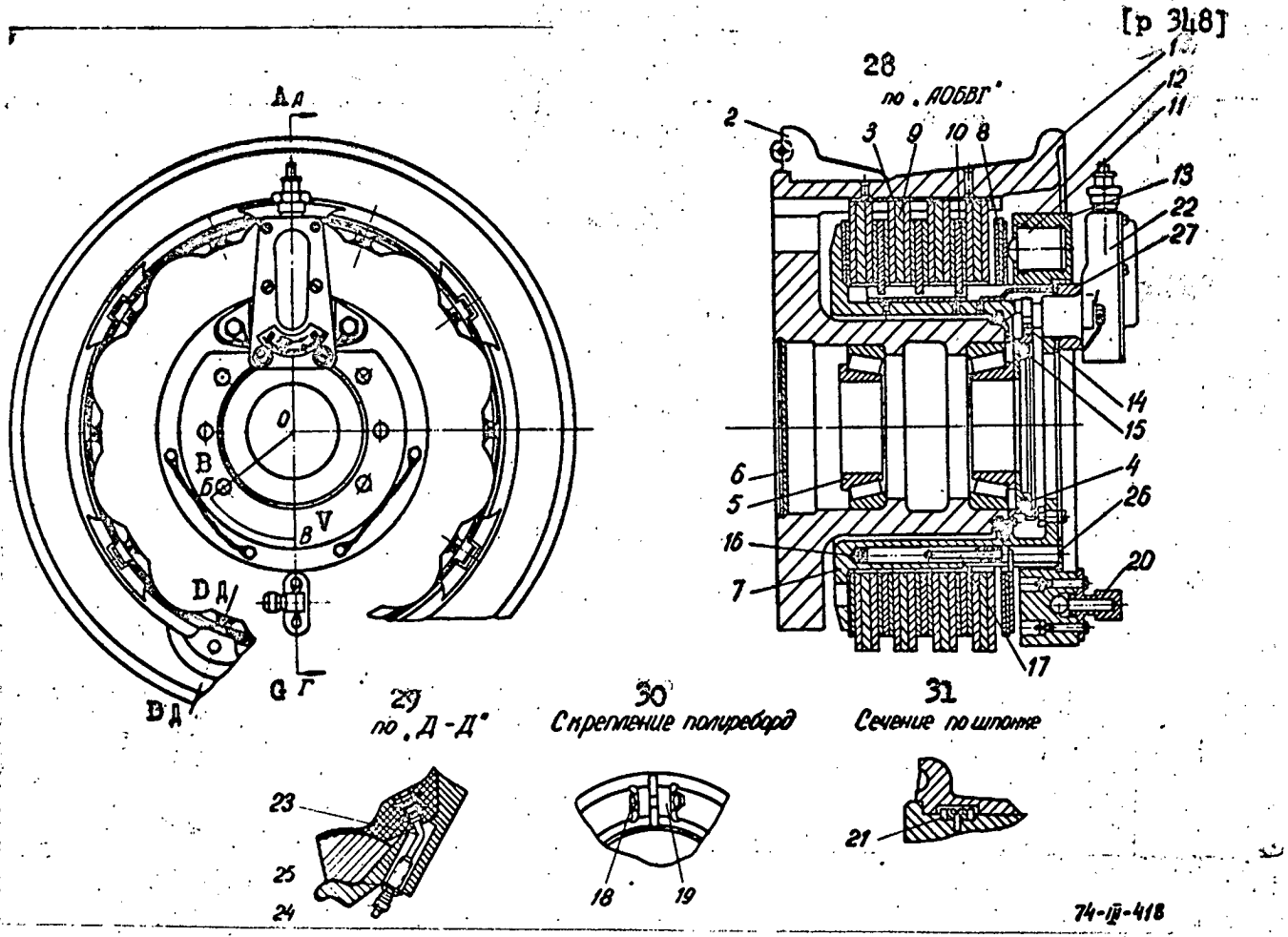


Fig. 72. The KT-82M wheel.

1. Drum
2. Wheel half-rim
3. Guide
4. Grease seal
5. Roller bearing
6. Cover
7. Carrier
8. Pressure plate
9. Bimetallic plate
10. Metalloceramic [powder metal] disk
11. Piston
12. Ring packing
13. Cylinder unit
14. Pinion
15. Pinion
16. Return spring
17. Pin
18. Bolt
19. Lug
20. Tubing connector
21. Key
22. Sensor
23. Valve stem
24. Valve cap
25. Valve retaining nut
26. Shield
27. Flange
28. Section through AOBVG
29. Section along D-D
30. Half-rim fastener
31. Section across the key

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f) On the intermediate pressure disks and back-up flange, crumbling of the metalloceramic around the entire perimeter of the sectors is permissible if the crumbled edge is no more than 12 mm wide.

g) Wear of the metalloceramic disks is permissible to a thickness of 6 mm, and the bimetallic disks, up to the appearance of the rivets.

h) When the total wear of the bimetallic and metalloceramic disks is such that the pressure plate piston travels outward more than 25 mm (see Fig. 72), the disks showing the greatest wear should be replaced.

i) Use of wheels in which the travel of the pressure plate when pressure is applied in the cylinder is equal to or exceeds 25 mm is not permitted.

k) Wheel lubrication is replaced every 3-months of aircraft operation. Grease to be used: NK-50 for the roller bearings.

6. REMOVAL OF LANDING GEAR WHEELS

Main Landing Gear Wheels

Raise aircraft on jacks.

Removal of wheels (Fig. 72) is done in the following sequence:

1. Disconnect air-supply hose from wheels.

2. Remove the UA-23/2M sensor from the wheel, first having disconnected the electric wire.

3. Remove the elastic release ring (No[-illegible], Fig. 72) from the wheel drum recess and remove the wheel cover (No 6., Fig 72). [P 350]

4. Unlock and back-off the wheel-axle nut and remove the retaining flange.

5. Remove the wheel from the axle, then the outer roller bearing, the

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wheel drum, the inner roller bearing and the grease seal.

Unscrew the nut and remove the bolts fastening the brake to the wheel axle flange.

7. Remove the wheel brake from the wheel axle.

NOTE: Do not remove the brake when changing tires.

8. Replacing the wheels is done in the reverse sequence with application of lubrication: for the roller bearings use NK-50 grease.

WARNING: When installing the wheel, tighten the wheel retaining nut slowly, while turning the wheel until it binds. Back off the nut 1/8 turn and then lock it. Overtightening the nut is strictly forbidden!

Nose Landing Gear Wheel (Fig. 73)

1. Disconnect the air lines from the connector of both wheel brakes.

2. Do not remove the UA-24 sensor, disconnect the electric wiring.

3. Unlock and unscrew the wheel axle retaining nut.

4. Remove the wheel axle from landing gear forks and then the wheel with a special extractor.

5. Remove the wheel from the forks.

6. Reinstallation of the wheel on the landing gear strut is done in the reverse order applying NK-50 lubricant (for the roller bearings), tighten the wheel nut against the retainer.

NOTE: When replacing the wheel, remove the brake. Unscrew the wheel nuts and remove the bolts holding the brakes to the braking flanges. Remove the flanges and install them on the new brake. Install the brake in the wheel.

7. CHECKING THE OPERATION OF THE MAIN LANDING GEAR WHEEL PIVOTING MECHANISM [P 352]

A. General Information

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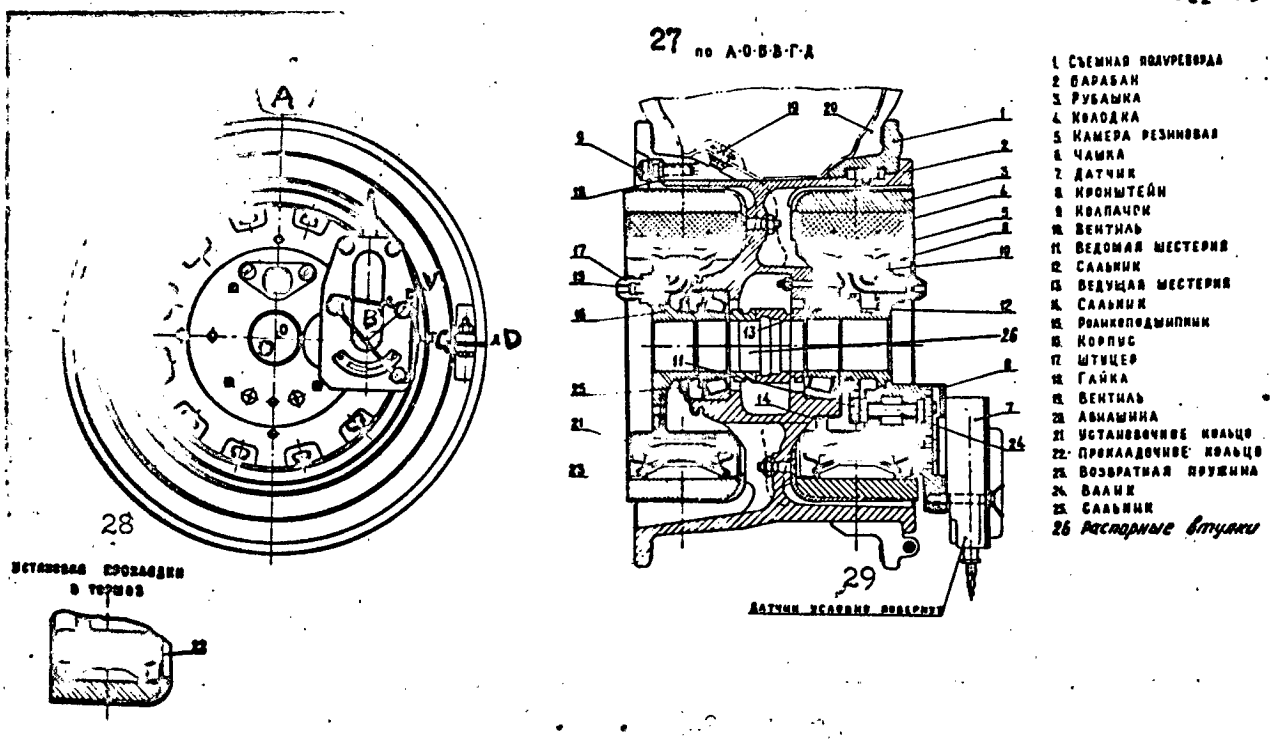


Fig. 73. The KT-38 wheel.

1. Removable half-rim
2. Drum
3. Lining
4. Shoe
5. Rubber chamber
6. Cup
7. Sensor
8. Retainer
9. Valve cap
10. Air valve
11. Pinion gear
12. Gasket
13. Drive gear
14. Seal
15. Roller bearing
16. Hub
17. Tubing connector
18. Nut
19. Air valve
20. Tire
21. Locating ring
22. Spacer ring
23. Return spring
24. Shaft
25. Grease seal
26. Spacer bushing
27. Section through AOBVGA
28. Arrangement of lining in brake
29. The sensor has been turned [for convenience of viewing]

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[p 353]

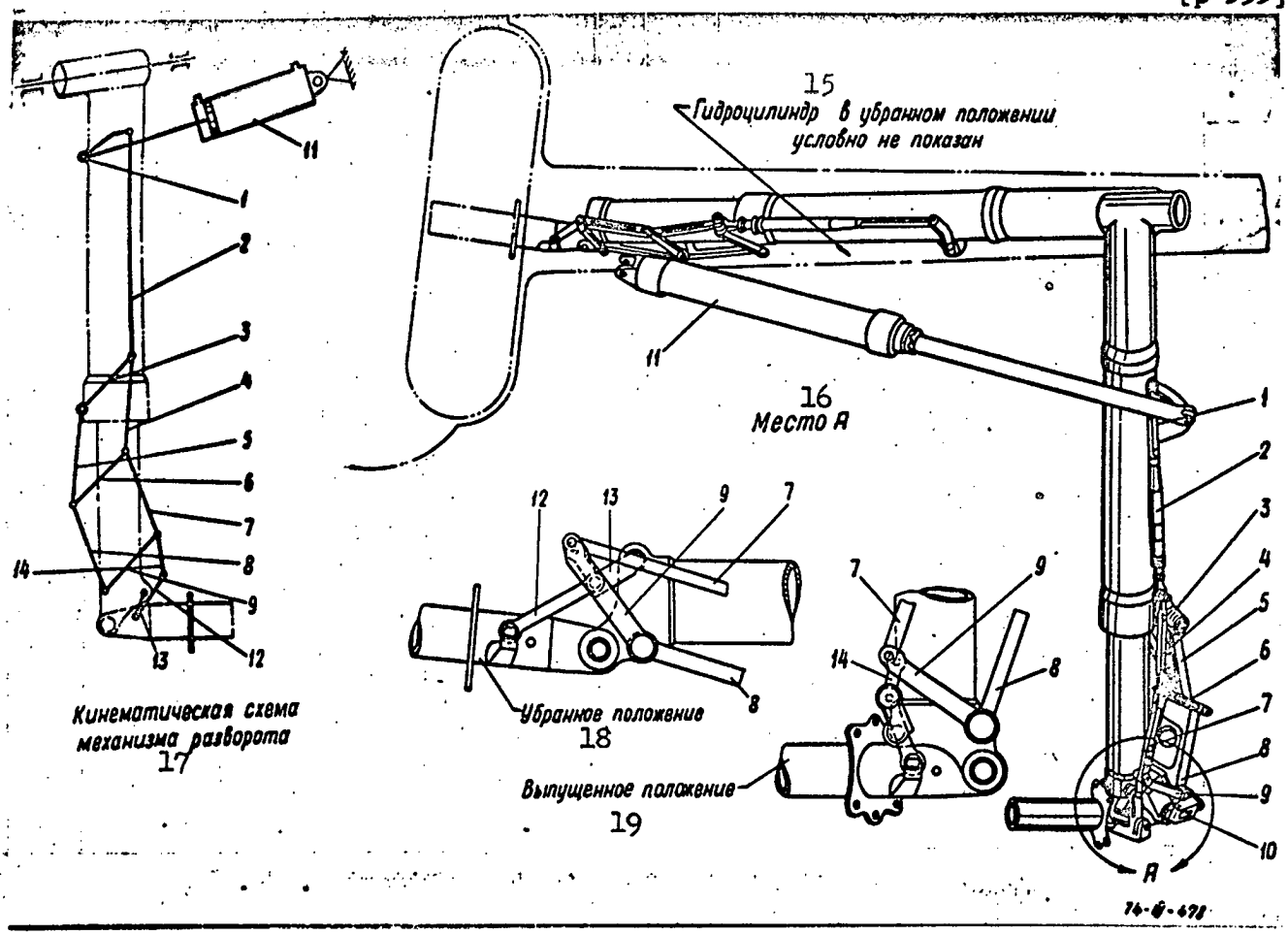


Fig. 74. Pivoting mechanism of the main landing gear wheels. [p 354]

1. Hinge fastening of the hydraulic cylinder piston rod
2. Control rod
3. Rocking arm
4. Push-pull rod
5. Upper cross-arm
6. Rocking arm
7. Push-pull rod
8. Lower cross-arm
9. Rocking arm
10. Bracket
11. Hydraulic cylinder
12, 13 - Push-pull rods for the kinematic locks
14. Short push-pull rod
15. Hydraulic cylinder not shown in the retracted position [for convenience of illustration]
16. Location A
17. Kinematic diagram of the pivoting mechanism
18. Retracted position
19. Extended position

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The main landing gears have a mechanism for pivoting the wheel half-axles and kinematic locks for securing them in the retracted and extended positions.

In extension and retraction, a pivoting of the hydraulic cylinder and the drag brace bolt fastened to it occurs about the axis of the drag brace bolt as the result of the changing angle between the longitudinal axes of the actuator cylinder and the strut. The rotation of the brace bolt during landing gear extension and retraction is utilized as the drive for the mechanism for pivoting the wheel half-axles of the main landing gears (see Fig. 74).

All push-pull rods of the mechanism for pivoting the wheels with the exception of the upper control rod, are non-adjustable. Adjustment of the kinematic lock is performed by changing the length of the upper control rod (see Fig. 75).

In operation it is necessary to keep check of the adjustment and see that the graduation lines on the upper control rod match (see Section "A" Fig. 75). In running a 50-hour maintenance check it is necessary to inspect and lubricate (TsIATIM-20I lubricant) all the hinged joints of the mechanism [P 355] and to check the clearance between the stop on the strut rod and the head of the thrust bolt on the half-axle (see Fig. 75, the view along "V-V").

B. Checking the Kinematic Lock

(Ground Check After 50-hours Flight Time)

Checking the kinematic lock must be done in the following sequence:

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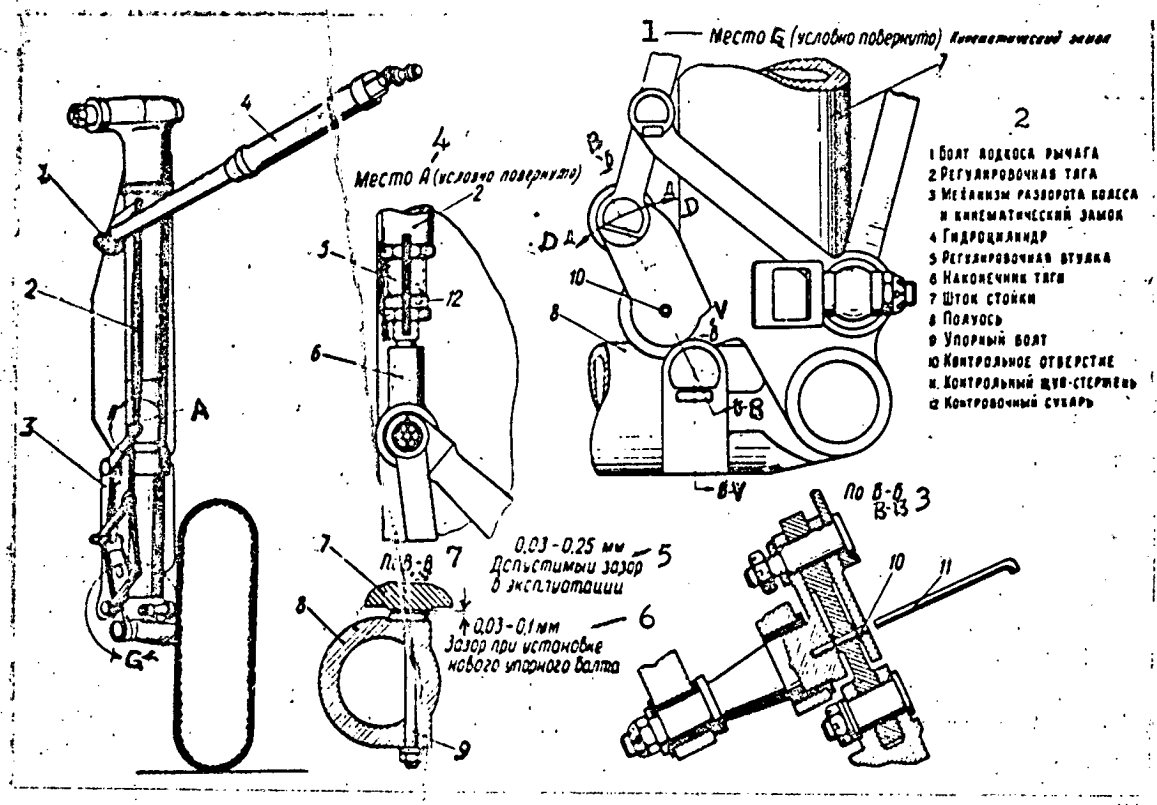


Fig. 75. Main landing gear wheel pivoting mechanism assembly.

1. Location G [turned for convenience of viewing], kinematic lock
2. (1) Crank lever bolt
   (2) Adjustment rod
   (3) Wheel pivoting mechanism and kinematic lock
   (4) Hydraulic cylinder
   (5) Adjustment sleeve
   (6) Rod tip
   (7) Strut rod
   (8) Half-axle
   (9) Stop
   (10) Check opening
   (11) Check rod
   (12) Lock washer
3. Along B-B
4. Location A (turned for convenience of viewing)
5. 0.03-0.25 mm permissible gap in operation
6. 0.03-0.1 mm clearance when installing new stop
7. Section V-V

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a) Raise the aircraft at the nose and wing jack points until wheels are clear of the ground.

b) Cycle the landing gear 2-3 times.

c) With the struts in the fully extended position, check the closing of the kinematic lock with a rod gauge of 3-0.05 mm diameter. With the lock fully closed the rod gauge must be able to freely enter the checkhole in the kinematic lock parts to a depth of not less than 22 mm (see the view along "B-B" in Fig. 75). If the check openings are not aligned in the kinematic lock parts (test rod will enter to a depth of 22 mm), the lock must be adjusted. To do this it is necessary to open and loosen the lock-nuts of the upper control rod No 2 (Fig. 75); remove the lock washers (2 pieces) No 12; by advancing or backing off adjusting sleeve No 5, adjust the kinematic lock so that the check openings are aligned as shown in "B-B" (fig. 75).

One full turn of the adjustment sleeve changes the rod length by 0.5 mm.

Advancing the sleeve shortens the rod (right-hand thread) and backing [p 357] off the sleeve lengthens the rod.

d) With the kinematic lock fully closed check the clearance between the strut rod and the head of the thrust bolt on the half-axle. The clearance should be 0.3-0.25 mm.

If the new clearance is more than 0.25 mm the thrust bolt must be replaced by a new one and the head of the bolt filed to ensure a clearance of 0.03-0.1 mm and a contact area at the bolt head base of not less than

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75%. After filing, carefully remove filings and cover the filed area with a thin layer of TsIATIM-201 grease (see view along "V-V", Fig 75.).

NOTE: 1. To facilitate measurement of the clearance and filing the bolt head it is permissible to disconnect the brake line from the wheel and the electrical lead from the UA-23/2M sensor.
2. Closing of the kinematic lock is checked only after the aircraft has been jacked free of the ground and the landing gear cycled 3 times. With the aircraft resting freely on its gear, play at the half-axle lock in the direction of the arrows "D-D" (see location "C", Fig 75) is permitted but not measured since it has no effect on the operation of the lock. Closing of the lock in this case is not checked with the 3-mm diameter feeler gage.

e) Jack the aircraft back down on its gear.

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C. CHECKING THE FITTING OF THE MAIN LANDING GEAR CYLINDERS TO THEIR MECHANICAL LOCKS [p 358]

(50-hour maintenance checks)

After checking the mechanism for pivoting the wheel of the main landing gear it is necessary to check its operation during extention and retraction of the landing gear and also to perform emergency extension of the landing gear with compressed air (see Chap. [?], Landing Gear Pneumatic System) to check the fitting of the main landing gear actuating cylinders to their mechanical locks. To do this, drop the air pressure which appeared in them after emergency extension and apply a force of about 50 kg to each wheel in the direction of retraction.

If the mechanical locks of the hydraulic cylinder are defective, the strut will move in the retracting direction. In this case the hydraulic cylinder must be replaced with a new one.

8. CHECKING NOSE GEAR VIBRASHOCK (DAMPER) OPERATION

A. General Information

The nose gear vibrashock (damper) is a compensating chamber which serves for refilling the working chamber in case of leakage and compensates for changes in the volume of the fluid as caused by heating or cooling of the vibrashock (damper) (Fig. 76).

The compensating chamber consists of a cylinder and a piston with [p 360] a connecting rod.

The rod extends out of the cylinder and has two check lines, a white one and a red one. Normal filling of the vibrashock with AMG-10 fluid at an ambient air temperature of + 20° C ± 10° is achieved when the white line is lined up with the top surface of the upper cover (see Fig. 76).

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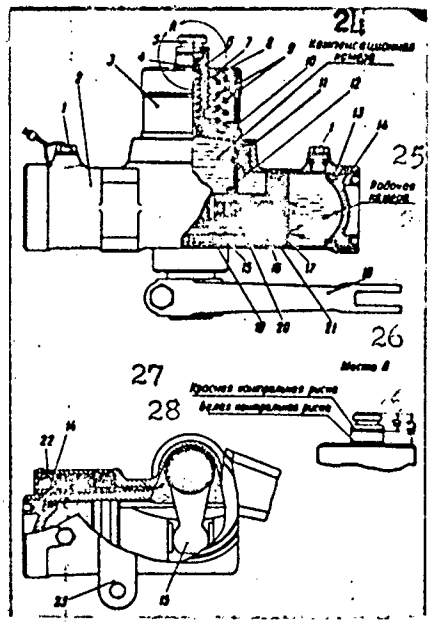


Fig. 76. The Vibrashock

1. Filler plugs
2. Cylinder housing
3. Compensating chamber housing
4. Ball of check valve
5. Filler plug
6. Rod with piston
7. Upper cover
8. Ball valve spring
9. Compensating chamber piston springs
10. Piston packing
11. Compensating chamber packing ring
12. Stop
13. Ring packing
14. Cover
15. Guide
16. Check valve
17. Choke
18. Lever
19. Piston
20. Side opening
21. Ring packing
22. Mounting
23. Ear for fastening
24. Compensating chamber
25. Working chamber
26. Location A
27. Red check line
28. White check line

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With change of the fluid temperature to + 55° C, for proper amount of liquid fill, the white check line can be 2-3 mm above the surface of the cap. At negative temperatures and with leakages from the vibrashock (damper), the white check line will sit at the level of the upper compensator cap or drop below it.

Normal operation of the vibrashock (damper) is permissible within the limits in which the red check line can be seen.

NOTE: The check lines are positioned as follows: the white at a distance of 18.5 mm, and the red at a distance of 10 mm from the top of the plug.

B. Vibrashock Operation

Caring for the vibrashock consists of: checking for external leak traces of the AMG-10 hydraulic fluid, periodic refilling of the compensating chamber with fluid, changing this fluid and cleaning the openings in the compensating chamber.

1. Filling the Vibrashock With AMG-10 Working Fluid

Filling of the vibrashock with fluid is conducted as follows: in [p 361] summer, at a temperature of 20°C±10°, directly on the aircraft and in winter, at a temperature of +20°C±10°C only after the damper has been in this place for not less than 3 hours.

Filling is done in the following order:

a) Set the damper in operating position (working cylinders are horizontal).

b) Unscrew the filler plug from the compensator rod and screw in the adapter coupling No 65641/233 (from set 1 of 4).

c) Connect the equipment and pump the AMG-10 hydraulic fluid into the compensating chamber; check the outward movement of the rod until it reaches a distance of 24 mm from the plane of the upper cover.

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d) Disconnect the equipment and unscrew the No 65641/233 adapter coupling.

e) Using a duraluminum rod, press the ball of the check valve (see Fig. 76) and bleed off the excess liquid until the white check line on the rod lines up with the top of the upper cover.

f) Screw in plug and safety it with KOK-0.8 lockwire.

ATTENTION: If the check lines on the rods are missing, the following measurements can be used for determining the proper rod position:

a) With a normally filled chamber, at a temperature of $20^{\circ}C \pm 10^{\circ}$ the rod will be pushed outward to a distance of 18.5 mm [measured] from the top of the fill plug to the top of the cover of the chamber.

b) The minimum outward position of the rod at which operation is permissible is 10 mm from the top of the plug to the cover. [p 362]

2. Changing the AMG-10 Hydraulic Fluid in the Vibrashock

Changing AMG-10 fluid is done indoors with a temperature of $20^{\circ}C \pm 10^{\circ}$ in the following order:

a) Unscrew the fill-plug from the rod, with a duraluminum rod press the ball of the check valve, bleed off all the fluid, and move the compensating chamber rod downward to the stop. Unscrew the compensating chamber (No 3) from the cylinder housing (No 2) (see Fig. 76);

b) Unscrew the fill plugs (No 1) and carefully drain the fluid from the vibrashock;

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c) Using clean AMG-10 fluid carefully wash the inside of the working chambers and the central chamber of the vibrashock, and also the compensating chamber which has been removed. Carefully pour off the washing liquid.

d) Install the vibrashock horizontally with the nonlinear drive pointing downward. Fill the working chambers through the fill openings to the upper fill marks under the cap and the central chamber of the damper to the upper mark of the housing with clean AMG-10 hydraulic fluid. (Temperature of the mixture used must be +20°C±10°).

e) Check the condition of the compensating chamber packing ring (11) and replace if necessary. Screw the compensating chamber into the vibrashock housing. Screw the compensating chamber in smoothly and carefully so as not to damage the packing ring. [p 363]

f) Unscrew the fill plug from the compensating chamber rod, screw the adapter into the rod and connect the equipment for adding the AMG-10 fluid;

g) Pump in the AMG-10 fluid with the equipment for this purpose until clear streams of fluid free of air bubbles flow from the fill openings of the working chamber;

h) Screw the plugs into the fill openings of the working chamber and make 3-4 full turns of the rocker lever from one stop position to the other. Set the lever in neutral position and again unscrew the plugs from the fill openings of the working chamber:

i) Again "pump up" the vibrashock, forcing AMG-10 fluid in until clear streams eject from the working chamber fill openings, after which stop adding fluid;

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k) Screw the plugs into the working chamber fill openings, lock and seal them;

l) Fill the compensating chamber as indicated in No 1 above.

NOTE: When filling, check to see that there are no air bubbles in the fluid flowing through the compensating chamber check valve. If air bubbles are noticed fill several times depressing the compensator rod each time till it touches the stop. When air bubbles stop, fill to point (1) according to section "B". [p 364]

9. CHECKING NOSE-GEAR-ONLY EXTENSION (Ground check)

1. Raise the aircraft by the wing and nose jacks until the wheels are free.

2. Connect the external hydraulic power source and retract the landing gear, set the gear selector valve in the "Neutral" position.

3. Using the nose gear extension handle, which is located in the cockpit below the instrument panel, open the nose gear uplock. The gear will extend under the action of its own weight. Push the gear up by hand until it engages the uplock and then lock the gear in this position. Check the gear position according to the electrical and mechanical signals and also check the clearance of the latch pin in the downlock, which should not be less than 6 mm.

After checking free nose gear extension set the handlever in its former position and safety with the KOK-0.5-type wire.

4. Make 3-4 extend-retract checks under hydraulic pressure.

5. Lower the airplane from the jacks.

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10. ADJUSTMENT OF MAIN LANDING GEAR POSITION INDICATING SYSTEM [p 365]
(when changing struts and uplocks, and after 50 hrs of flight time)

A. Extended position of the main landing gear

Proper adjustment of the system for signaling the extended position of the main gears should ensure switching on of the bulb (green light) for signaling the extended position of the main gears at the very end of strut travel, i.e. in the last 0.5-1.6 mm travel of the downlock catch on the strut.

Adjustment of the system for signaling the extended position of the main landing gear is performed in the following sequence:

1. Raise the aircraft by wing and nose jacks until the wheels are free.

2. Connect external electrical and hydraulic power sources to the aircraft.

3. Engage the main landing gear strut cylinders to their mechanical locks by doing the following: set the landing gear valve lever in the "retract" position and "break" (by hydraulic pressure) the main struts to an angle of 45-50°.

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After this, set the landing gear valve lever in the "extend" position and after full extension of the landing gear, hold the valve lever in this position for 1-2 minutes and then set it in the "neutral" position.

4. After applying force to the wheel in the retract direction, try to retract the strut by jerking the wheel with the hands.

If a sharp knock is felt while doing this, then mechanical locks are closed.

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5. After having made certain that the mechanical lock of the hydraulic [p 366] cylinder is closed, adjust the limit switch in the following sequence:

a) Advance the adjustment screw on the rod of the pressure device in the MVSh-2T limit switch until it comes to a stop (see Fig. 77).

b) Apply a force of 50 kg to the wheel axle in the extend direction, and, holding the strut in this position, carefully, while making certain not to move the rod of the switch, back off the adjustment screw (Fig. 77) to the moment the green light on the PSS-2 panel in the cockpit goes on. After this, back off the adjustment screw another 1/2 to 1 1/2 turns.

While applying a force of 50 kg to the wheel axle in both extend and retract directions, i.e. to see if there is any strut play, make certain that the green indicator light on the PSS-2 panel in the cockpit does not go off.

Push the rod of the switch in as far as it will go and measure the distance the rod is free to travel. This must be no less than 4 mm (see Fig. 77).

d) Lock the adjustment screw.

6. After adjusting the microswitches it is necessary to make 3-4 test cyclings of the landing gear to confirm the reliability of signal operation.

7. If the signaling system does not function consistently it is necessary to unlock the adjustment screw, back it off 1/2 turn, lock it again and repeat the operations in No. 6 [immediately above].

NOTE: 1. This procedure applies to aircraft Nos. 1701 and up.
2. No provisions are made for adjustment of aircraft up to No. 1701.

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B. Main landing gear in the retracted position [p 367]

With the aircraft still up on the jacks and the main landing gears in the extended position, check the adjustment of the MVSh-2T limit switch for the retracted position in the following sequence:

1. Make certain that the mechanical uplock of the main gear is in the open position and the hydraulic cylinder rod is retracted.

2. Check the clearance between the rod of the MVSh-2T switch (retracted position) and the lock lever, which should be 0.2-0.5 mm (see Fig. 77).

3. Close the lock (retracted position) by hand.

4. Check the play of the MVSh-2T rod which should be no less than 4 mm (see Fig. 77).

5. Alignment of the axis of the MVSh-2T rod with the center of the seat on the lock level should not deviate more than 2 mm.

6. Make certain the adjusting bolt is locked (Fig. 77).

7. Test cycle the landing gear 3-4 times and check the reliability of the signaling system (burning of the red light on the PSS-2 panel in the cockpit) when the landing gear is retracted and the gear selector valve is in the "Neutral" position.

8. Lower the aircraft to the ground by the jacks.

9. Disconnect external electrical and hydraulic power sources from the aircraft.

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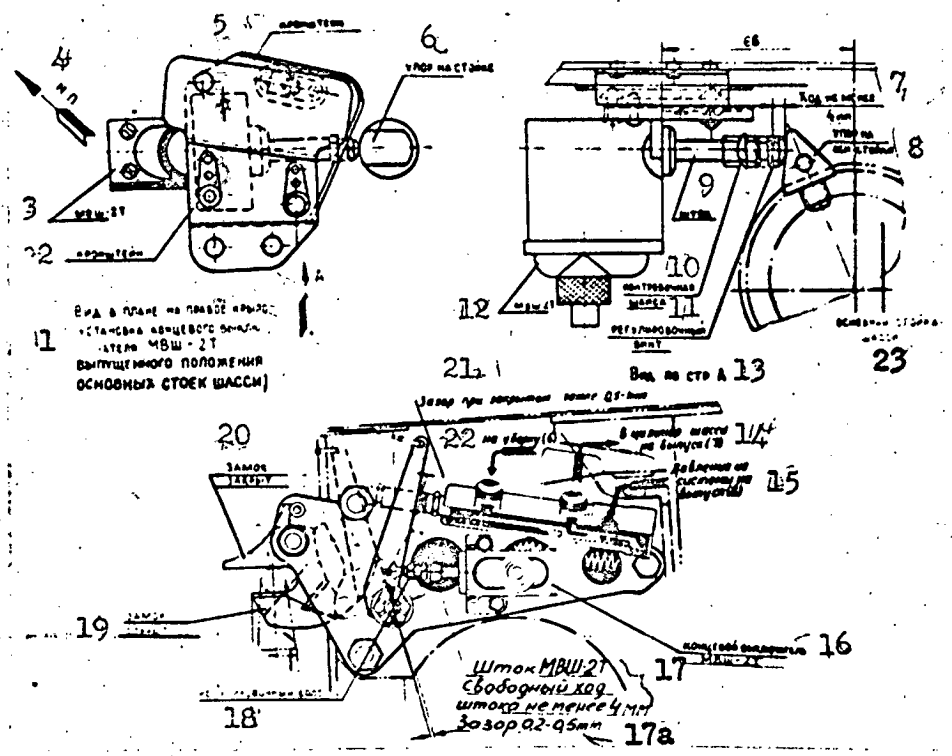


Fig. 77. Adjustment of the main landing gear position signaling system.

1. View in plane of right wing (MVSh-2T switch unit for signaling RETRACTED position of main gear)
2. Support
3. MVSh-2T
4. Support
5. Stop on strut
7. Travel not less than 4 mm
8. Stop on strut
9. Rod
10. Lock washer
11. Adjustment screw
12. MVSh-2T
13. View along arrow A
14. To landing gear cylinder for extension (7)
15. Pressure from system for extension
16. MVSh-2T limit switch
17. Rod of MVSh-2T (Free travel of rod not less than 4 mm)
17a. 0.2-0.5 mm clearance
18. Adjustment bolt
19. Lock open
20. Lock closed
21. Clearance with lock closed, 0.5-1 mm
22. For retraction
23. Main landing gear strut

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11. EXTENSION AND RETRACTION OF THE FLAPS [P 369]

Extension and retraction of the flaps is performed when there is operating pressure in the main hydraulic system and with an external electric power source connected, or when the aircraft battery is switched on, while the engine is operating, in the following sequence:

1. Close the switch marked "Battery, aircraft-external."

2. Reset the AZS [circuit breaker] marked "Landing gear, Flaps" and the "Landing gear [signal lights] ANO" which are located on the right control panel.

3. Connect the external electrical power source and hydraulic pump (to the main hydraulic system fixture) to the aircraft.

4. Press the button marked "Extended" on the "M3-1" whereby the GA-185 flap valve will cycle and the flaps will begin to extend. When the flaps are in the fully extended position, a light in the cockpit with the superscript "Flaps extended" will go on.

If at this time the landing gears are not extended, then a light on the PPS-2 panel marked "Extend the Landing Gear" will go on.

5. Press the "Retracted" button, whereby the GA-185 flap valve will switch and the flaps will retract.

NOTE: 1. When any one of the buttons on the M3-1 panel is pressed, it will remain depressed, whereas any button which had been depressed previously will return to the initial position.

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12. CHECKING FLAP SERVICEABILITY [P 370]

In making an inspection of the flaps for any defects, the following should be done:

1. Carefully examine the condition of the trailing edge "knives" of the flaps. Make sure there are no dents, cracks, damage to the cover or other defects in the "knives" of the flaps.

2. Inspect the skin covering the flaps for any dents, nicks, bends, and check the condition of riveted joints.

3. Run an extension and retraction test on the flaps. Check the maximum deflection (extension) in accordance with leveling specifications (see Chap. XI) and at the same time make certain that the actuator cylinders and the GA-185 hydraulic-electric valve function properly and ensure normal extension and retraction.

4. Nonsynchronization of flap retraction or extension is permissible if it is of the following form: one flap has completely extended or retracted whereas the other is just beginning to extend or retract, however, with the actuator rod disconnected from the lagging flap, a force of no more than 5 kg, applied to it at the middle of the flap trailing edge, should be necessary to extend or retract it.

NOTE: 1. Nonsynchronization of the flaps under operational conditions (in fighter units) must be checked in the following cases: upon appearance (detection) of nonsynchronization in more than one full cycle of the flaps and upon complaint by the pilot as to change in the lateral stability of the aircraft. [P 371]

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2. Upon extension of the flaps prior to takeoff, the aviation technician must check to see that both flaps are fully extended.

5. Check to see that the flap position signaling system is in working order by pressing the respective buttons on the M3-1 flap panel (in the cockpit) and seeing that the corresponding lights on the PPS-2 panel in the cockpit go on.

13. RELEASE AND JETTISON OF THE BRAKE PARACHUTE

Release and jettison of the brake parachute is initiated from the cockpit with at least 30 kg/cm^2 pressure in the pneumatic system, in the following sequence:

1. Switch on the battery and the AZS [circuit breaker] marked "Brake Parachute" on the right side of the cockpit.

2. Press the button on the instrument panel with the superscript "Parachute Release", whereby the electro-pneumatic valve will cycle and feed air into the cylinder for opening the parachute doors, after which the parachute will drop from its container.

3. To jettison the parachute, press the button on the left side with the superscript "Jettison Parachute", whereby the second electro-pneumatic valve will cycle and feed air into the cylinder for opening the brake chute riser attach lock. The lock will open and free the riser.

NOTE: After each installation of the container with the brake parachute, make a single check of door opening by pressing

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the "Parachute Release" button while holding the left door up with the right shoulder. If the doors have a tendency to open (press against the shoulder), then the system is in good working order. After this check, close the doors and safety the lock catch with M2-K1-type wire. [p 372]

14. STOWING THE BRAKE PARACHUTE IN THE AIRCRAFT

After a landing in which the brake parachute was employed, unhook the riser from the lock (if the parachute had not been jettisoned during the landing run), clean the compartment of dust, dirt, snow or moisture. Inspect the doors and locks for any damage and stow a new parachute in the compartment.

Gather up the used parachute, fold it, and pack it in the deployment bag in accordance with the instructions for packing and operation of a PT-6152-59-type parachute (the later series are of the PT-21 type).

Five flaps made of a special fabric which are riveted on the container are used to cover the parachute and hold it in the container while it is being stowed in the aircraft. The side (upper and lower) flaps have loops through which a cable with a red flag is passed after the parachute has been placed in its container (Fig. 79).

Stowage of the brake parachute in the aircraft is performed in the following sequence:

1. In the container which has been removed from the aircraft, lay the riser in a figure eight configuration in such a manner that one end of the riser protrudes out of the container in the rear right corner

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[p 373]

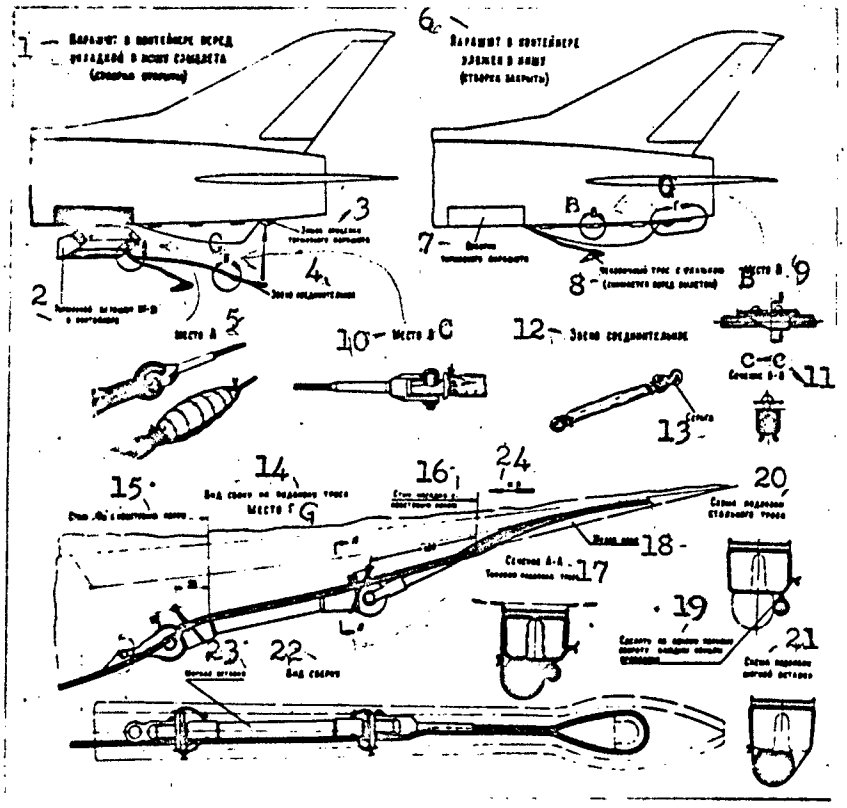


Fig. 78. Installation of the container with the brake parachute in the compartment of the aircraft and attachment of the riser.

1. Parachute in its container prior to stowing in the compartment of the aircraft. (Doors are open)
2. PT-21-type brake parachute in its container
3. Brake parachute attach lock
4. Connecting link
5. Location A
6. Parachute in its container stowed in the compartment. (Doors are closed)
7. Brake parachute doors
8. Flap cable with flag (removed before flight)
9, 10, and 11. Locations B, and C, and Section C-C
12. Connecting link
13. Eye ring
14. Section G - Side view of riser attachment
15. [illegible]
16. [illegible]
17. Section A-A, normal attachment of the riser
18. Groove in the skin
19. Make one full turn with each end of the wire
20. Diagram showing the suspension of the steel riser
21. Diagram showing attachment of the soft insert
22. Top view
23. Soft insert
24. Forward

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(looking forward), Then place the parachute which has been packed in its deployment bag on top of the riser (packing of the parachute in its deployment bag is performed in accordance with Instructions No 2010-59 (according to instructions No 315-61 for the PT-21-type parachute)) with the open end forward and carefully smooth it out in the container. Place the pilot chute on the rear flap of the container in the upper right corner (Fig. 78).

2. Cover the parachute and riser with the flaps as follows: first [p 374] fold over the front flap, then the rear one, and then fold over the right and left (upper and lower) flaps and hold them in check with the cable with the red flag attached, and last, fold over the fifth (protective) flap.

3. Stow the container with parachute in the fuselage compartment of the aircraft (Figs. 79 and 80), making certain that the doors are in the full-open position and secured by the levers of the spring mechanism, and that the piston rod of the pneumatic cylinder for actuating the doors is retracted (Fig. 80).

NOTE: 1. The doors are opened by turning the hexagonal fitting of the lock on the outer door (the line on the lock should stop in the "Opened" position) or by pressing the "Parachute Release" button which is located in the cockpit.

2. When opening the doors, hold them up with the hands and take the proper precautionary measures for the moment of opening to avoid hand injuries since each door opens sharply through the action of the springs.

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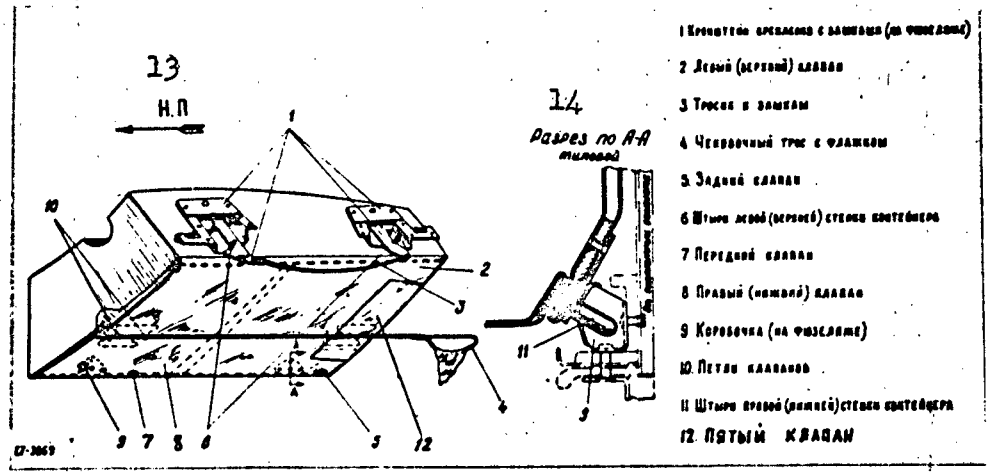


Fig. 79. Suspension of the brake parachute container.

1. Fastening brackets with locks (on the fuselage)
2. Left (upper) flap
3. Small cable to the locks
4. Check cable with flag
5. Aft flap
6. Pins on left (upper) side of the container
7. Front flap
8. Right (lower) flap
9. Little pod (on the fuselage)
10. Small receptacles
11. Pins on right (lower) side of the container
12. Fifth flap
13. Forward
14. Section along A-A. (typical)

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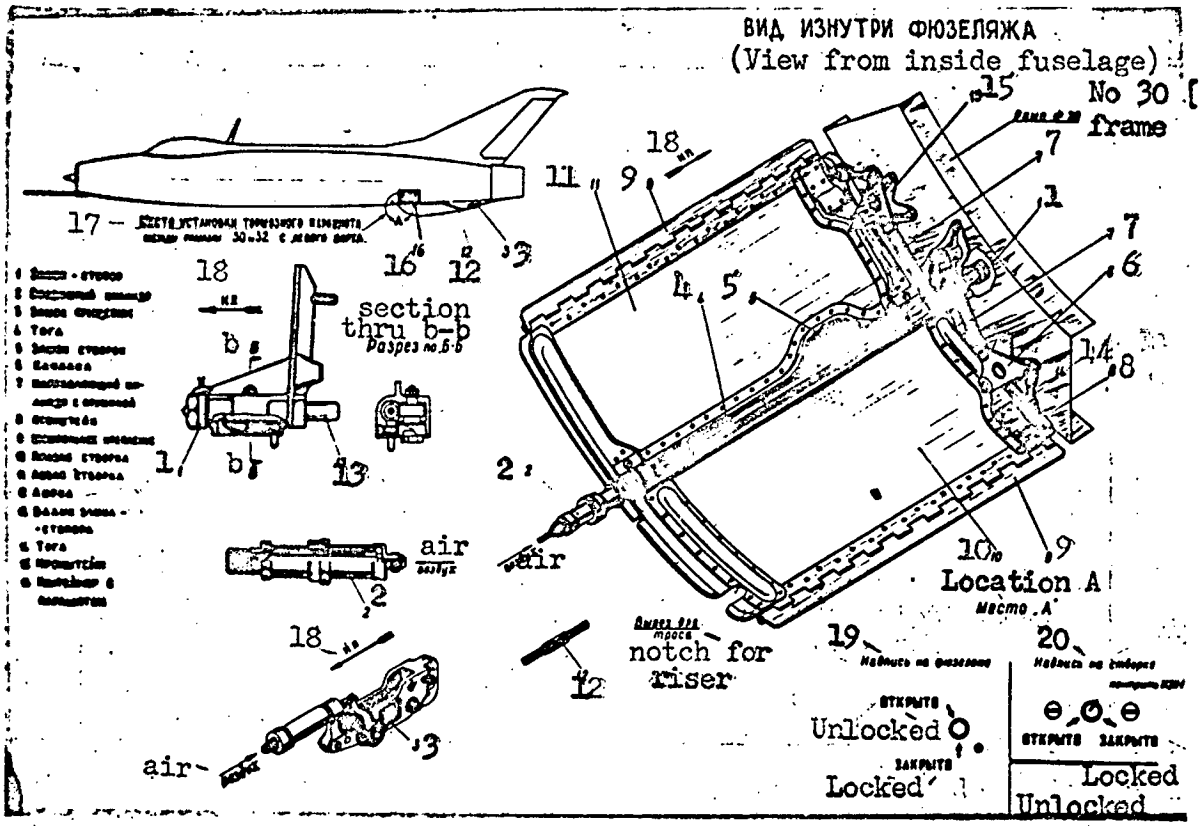


Fig. 80. Brake parachute doors.

1. Catch lock
2. Pneumatic cylinder
3. Attach lock
4. Push-pull rod
5. Door lock
6. Bellcrank
7. Guide cylinders with springs
8. Bracket
9. Longitudinal attachment
10. Right door
11. Left door
12. Clevis
13. Bolt of the catch lock
14. Push-pull rod
15. Bracket
16. Container with parachute
17. Location of brake parachute installation between No 30 and No 32 frames on left side
18. Forward
19. Inscription on fuselage
20. Inscription on door Safety with [?]

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Bring the lower right side of the container with the parachute up into the compartment (recess) of the fuselage in such a manner that the pins will enter the openings of the small receptacles on the fuselage (Fig. 79).

Bring the left upper side of the container up into the compartment (recess). Pull the lock cable and open the locks and then, after having made certain that the pins on the left wall of the container have entered the locks on the fuselage, lower the small cable.

Make certain that the container is kept closed by the locks and the [P 377] fifth (protective) flap.

WARNING: When stowing the container with the parachute in the fuselage brake parachute compartment:
1. Take precautionary measures so as not to withdraw the parachute checking cable or break the binding threads.
2. Make certain that the fifth (protective) flap does not fall into the slot between the aft edge of the container and the door seals.

4. Close the parachute compartment doors, beginning with the right (lower) (after folding the door lever), and then the left (upper) and, while holding the doors closed by hand, withdraw the parachute check cable (Figs. 79 and 80).

5. Lock the doors as follows:

After closing the doors tightly, turn the lock pin with the key. The lock is located on the left door (a hexagonal recess). While pressing the doors tightly, close the forward lock by pressing the lock latch, and then turn the lock pin with the key (in the hexagonal recess

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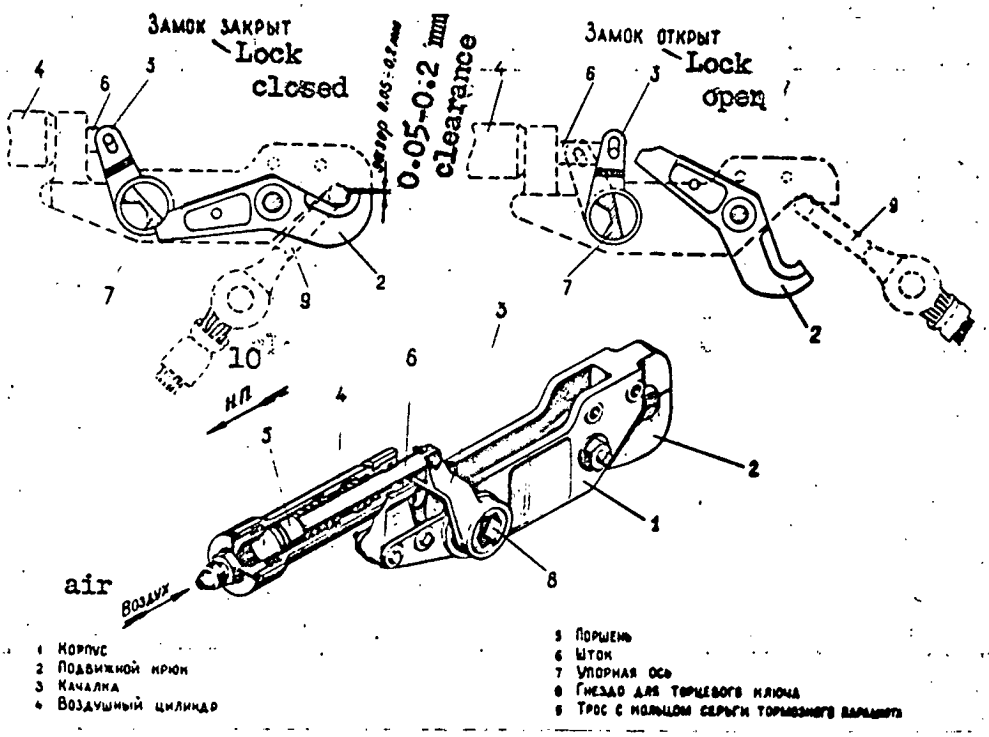


Fig. 81. Brake parachute attach lock

1. Case
2. Movable hook
3. Rocking arm
4. Pneumatic cylinder
5. Piston
6. Piston rod
7. Thrust pin
8. Wrench socket
9. Eye ring on brake parachute riser
10. Forward

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located in the skin of the fuselage forward of the doors (Fig. 80)).

6. Make certain that the check lines on the lock pins line up with check lines on the skin of the fuselage and then safety the hex fitting of the lock with M2-K1 wire (Fig. 80).

7. If the attach lock for the brake parachute is closed (Fig. 81), it can be opened by pressing the "Parachute Jettison" button in the cockpit or with the use of a socket wrench.

8. Slip the ring of the parachute riser connecting link on the hook of the catch and close the lock (see Fig. 78).

9. Press the riser and connecting link of the parachute into the [P 379] clamps (spring clips) on the ventral fin and in the groove of the tail skin. The clamps (spring clips) must hold the riser tightly over its entire length. It is inadmissible if the riser works free of the clamps (spring clips). Bind the connecting links with wire and twine (see Fig. 73). Removal of the brake parachute and its container from the aircraft is done in the reverse sequence.

15. CHECKING THE OPERATION OF THE BRAKE PARACHUTE SYSTEM

During maintenance work after 50 hours of flight time, make the checks in the following sequence:

1. Spread a tarpaulin under the parachute compartment of the fuselage to protect the parachute against contamination when it drops out.

2. Make certain that doors of the parachute compartment are closed tightly and that the lock is safetyed.

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3. Make certain that the pressure in the pneumatic system is not lower than 50 kg/cm^2 (the normal operating pressure).

4. Press the "Parachute Release" button. Upon doing this, the safety wiring is sheared, the doors open and the brake parachute drops out of its container in the parachute compartment under the action of its own weight. The doors should remain in the open position.

5. Apply a force of 5 to 15 kg to the riser of the parachute and press the "Parachute Jettison" button. The lock should open.

Repeat operations 4 and 5 above with a pressure of 30 kg/cm^2 in the pneumatic system (the minimal pressure at which the system will function).

Upon completion of the test, put the system back in its initial condition.

6. Check the fitting of doors of the brake parachute container to the skin of the fuselage and make certain that brake parachute compartment is airtight.

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CHAPTER VII

THE PRESSURIZED COCKPIT

1. General Information

The pilot's cockpit is of a pressurized, air conditioned type with [p 380] automatic remote-electrical control of the air system.

At altitudes from 0 to 2000 meters, supply of air to the cockpit is free. From an altitude of 2000 meters and up a pressure differential is created in the cockpit which increases smoothly with climb of the aircraft and reaches a value of $200^{+}_{-}10$ mm Hg (0.3 kg/cm^2) at an altitude of 9,000-12,000 meters. This differential is maintained up to the ceiling of the aircraft without change.

Cockpit pressure is controlled by an ARD-57B pressure regulator.

Over-pressurization is prevented by means of the PK safety valve which is pre-set for a pressure [maximum] of 0.35 kg/cm^2.

The pressure differential between the cockpit and the ambient atmosphere, which determines the cockpit "altitude", is regulated in accordance with the readings of the UVPD-20 indicator.

Air is supplied to the cockpit by the compressor of the engine (Fig. 82).

Air from the compressor flows into an electric air distributor valve, the 525(14) unit, and then to the cockpit air control valve (8) via the "cold" or "hot" lines. Along the "cold" line the air passes through the air-to-air radiator (13), where it is cooled, and through the turbo-cooler to the [p 383] check valve (11). Along the "hot" line, the hot air also flows to the

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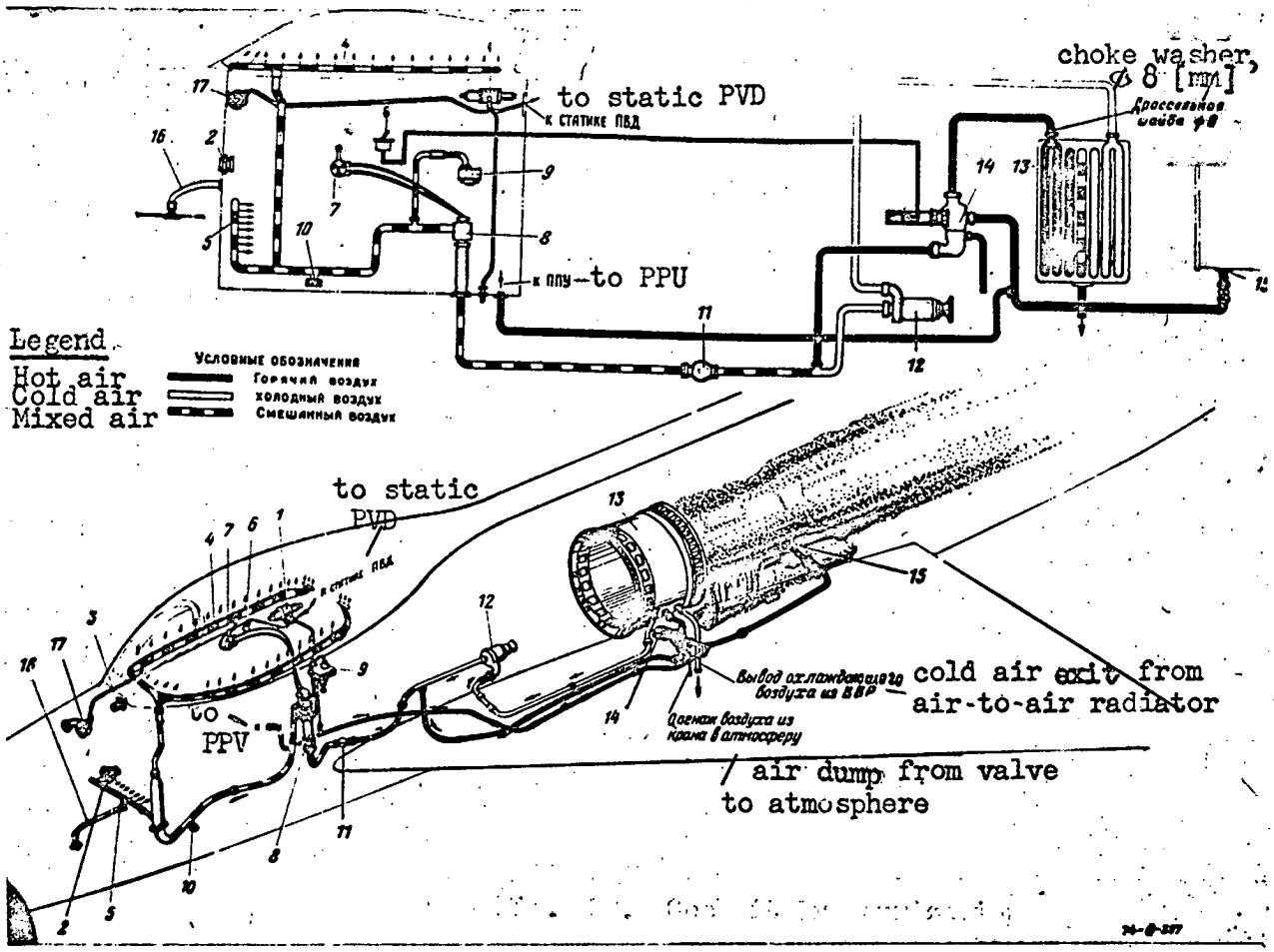


Fig. 82. Cockpit pressurization and air conditioning. [p 382]

1. ARD-57V pressure regulator
2. "PK" safety valve
3. UVPD-20 altitude and pressure differential indicator
4. Canopy air manifold
5. Foot heater manifold
6. 4-position switch
7. Cockpit valve lever
8. Cockpit air valve
9. TRTVK-45M temperature regulator
10. Manifold air limit valve
11. 738I check valve
12. 477D turbo-cooler
13. Air-to-air radiator [heat exchanger]
14. Electric air distributor valve
15. Engine bleed air
16. External air conditioning connector
17. 520B pressure regulator valve

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check valve but by-passes the cooling units.

Prior to entering the cockpit, the lines join into one and the "mixed" air passes through the check valve to the cockpit air control valve. From the air supply valve the air is ducted to the manifolds around the base of the canopy (4) and the pilot's feet (5).

An "air-flow limit valve" (10) is installed on the line leading from the supply valve to the canopy and windshield manifolds, which automatically maintains a constant flow of air.

In the event that the air pressure in the manifolds is higher than 0.12 kg/cm^2, the limit valve transfers part of the air from the main supply line to the cockpit.

Air from the same line is diverted to pass over the coil of the TRTVK-45M temperature regulator.

Air from the cockpit which blows about the coil of the regulator coil simultaneously brings the value of the regulator temperature to that of the mean value of the cockpit temperature.

Remote electrical control of the cockpit air supply system is achieved by the 4-position switch (6) marked "Cabin Heating."

The switch has four positions: "Hot", "Cold", "Automatic", and "Neutral". In the neutral position, the cockpit air system is turned off.

When the switch is set in the "Hot" position, the electrical distributor directs only hot air from the engine compressor to the cockpit. When the switch is set in the "Cold" position, the air distributor directs only cold air into the cockpit (through the air-to-air radiator and the turbo-cooler). [p 384]

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When the switch is set in the "Automatic" position the air distributor valve is controlled automatically by the TRTVK-45M temperature regulator, (9), which maintains the temperature of the cockpit air at the pre-set level.

The desired temperature is set on the scale of the automatic regulator by turning the knob.

The regulator can be set for any temperature from +16°C to +20°C (on the numbered scale).

ATTENTION: The required temperature is preset on the ground only by the mechanic. It is recommended that the regulator be set for a temperature of +16°C.

When the temperature of the cockpit air deviates from the preset value, the regulator switches in one or the other of the coils of the electrical reversing mechanism of the air distributor valve; the electrical mechanism turns the gate of the air distributor valve accordingly and directs either hot or cold air into the cockpit. [p 385]

After the preset temperature has been reached in the cockpit, the automatic regulator opens the electrical circuit whereby the air distributor valve is left in a position at which hot and cold air is supplied to the cockpit in the required ratio.

ATTENTION: To ensure proper operation of the cold air line, in the distributor valve there is a hot air dump line through which the hot air, after it has passed through the valve gate of the hot line, is dumped into the atmosphere.

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2. Location of the instruments and units comprising the cockpit air conditioning and pressurizing systems

The air-to-air radiator is installed between frames 21 and 22. It is designed for cooling the air prior to its arrival at the turbo-cooler. As the hot air passes through the air-to-air radiator it gives up approximately 80% of its heat.

The 525 electric air distributor valve assembly is installed on frame 22.

This valve is the actuating mechanism in the system for remote automatic control of the cockpit air temperature and is designed for distributing the air going into the cockpit along the "Hot" or "Cold" lines, or both [p 386] lines simultaneously. The electric air distributor valve is controlled by the TRTVK-45M automatic temperature regulator.

The 477D turbo-cooler assembly is installed between frames 14 and 15, below and to the right. The turbo-cooler is designed for cooling the air which passes from the air-to-air radiator into the pressurized cockpit of the aircraft.

The cockpit air supply valve is installed in the cockpit on frame 11. The gate of this valve has two fixed positions, "open" and "closed."

Valve regulation is done by a control handle on the right cockpit console (Fig. 83)

In the event that smoke, kerosene or oil fumes from the engine enter the cockpit, it is necessary to switch-off air from the engine to the cockpit by setting the air control valve lever in the "closed" position.

When the aircraft is parked the cockpit air supply valve should always be kept closed.

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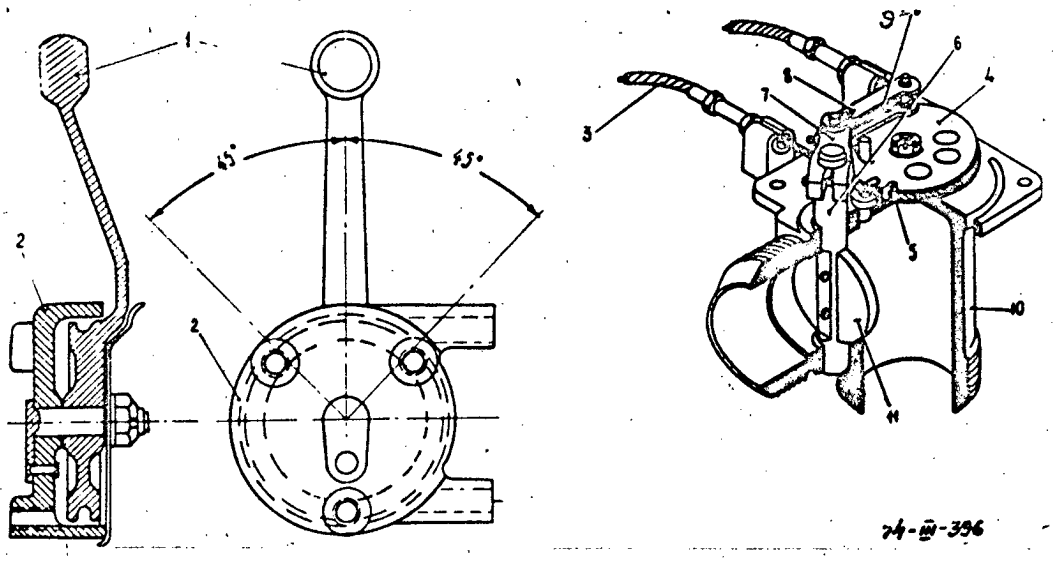


Fig. 83. The cockpit air supply valve.

1. Valve control lever
2. Housing
3. Cable in a bowden
4. Pulley
5. Small cylinder
6. Pivot shaft
7. Guide
8. Connecting rod
9. Spring
10. Valve casing
11. Valve gate [butterfly valve

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The valve is opened prior to engine starting; starting and running the engine with the valve closed is not recommended.

ATTENTION: If the ambient temperature in the summer time is 2-6°C below the temperature set on the scale of the temperature regulator, it is recommended that the electric air distributor valve be set in the "cold" position prior to engine starting to avoid filling the cockpit with hot air in the first few moments. [p 388]

The ARD-57 Air Pressure Regulator

The ARD-57V air pressure regulator is installed in the cockpit to the right on the sub-canopy panel between frames 10 and 11 (Fig. 84).

The air pressure regulator is designed for automatic maintenance of air pressure in the cockpit by means of regulating the output of air from the airtight cockpit.

The pressure regulator consists of two units: a regulator (sensor) and a 520B valve (actuating mechanism). The 520B valve is located in the cockpit on frame 6.

On the regulator there is a valve, with the lever of which the regulator can be set in three positions: "On," "Off," and "Test" (the "Test" position is not used during operation).

When the lever is set in the "On" position, the regulator is switched in for flight, i.e., in this position normal operation of the regulator is ensured during flight.

The lever should be locked in this position.

When the lever is set in the "Off" position, the regulator shuts off the exhaust of air from the cockpit through the 520B valve. Cockpit pressurization is also tested in this position while the aircraft is on the ground.

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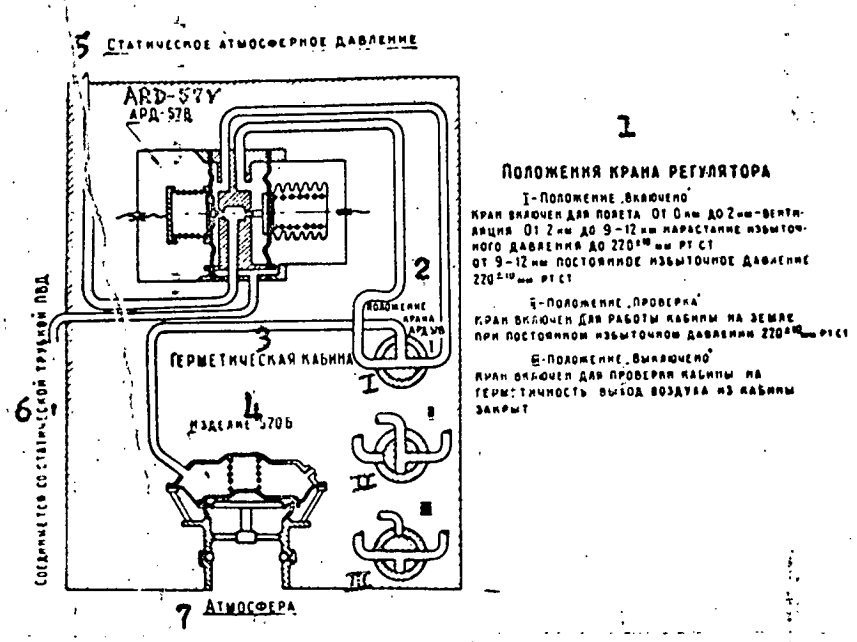


Fig. 84. Diagram showing the operation of the ARD-57V pressure regulator with the 520B valve.

1 - Regulator Valve Positions

I. "On" Position

Valve is switched in for flight from 0 to 2 km, air conditioning from 2 km to 9-12 km. Gage pressure increases to 220±10 mm Hg.

II. "Test" Position

Valve is switched in for cockpit operation on the ground at a constant gage pressure of 220±10 mm Hg.

III. "Off" Position

Valve is switched on for testing cockpit airtightness. Exit of air from the cockpit is shut off.

2 - Position of the ARD-57V valve
3 - Pressurized cockpit
4 - 520B part [valve]
5 - Static atmospheric pressure
6 - Connects to the PVD static tube
7 - Atmosphere

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The PK safety valve is installed in the cockpit on frame 6. [p 390]

The safety valve is designed for protecting the cockpit against any failure which could occur if the pressure exceeds the permissible limit. When the gage pressure in the cockpit is 235-240 mm Hg, the valve opens and dumps the excess air from the cockpit.

The UVPD-20 "altitude" and pressure differential indicator, which is installed on the lower part of the instrument panel, measures the "altitude" in the cockpit and pressure differential between the cockpit and the ambient atmosphere in the altitude range from 0 to 20 km and pressure differentials from -0.04 to +0.6 kg/cm^2.

The TRTVK-45M temperature regulator (Fig. 85) is installed in the cockpit behind the pilot's seat, to the left on frame 11.

The temperature regulator is designed for automatic maintenance of the air temperature in the cockpit within specified limits (the 525 distributor valve is the actuating mechanism).

With the dial, the cockpit air temperature can be set within the limits from 16 to 20°C. Normally the dial is set at +16°C.

The 4-position switch marked "Cabin Heating" is installed on the [p 392] horizontal portion of the right panel in the cockpit and is designed for controlling the distributor valve.

The 738 check valve unit is installed between frames 12 and 13, at the bottom. This valve permits air to flow in only one direction -- from the engine into the cockpit. When the engine is shut off or the cabin air supply line is damaged, this valve closes and prevents loss of air from the cockpit. An arrow stamped on the valve housing indicates the direction of air flow.

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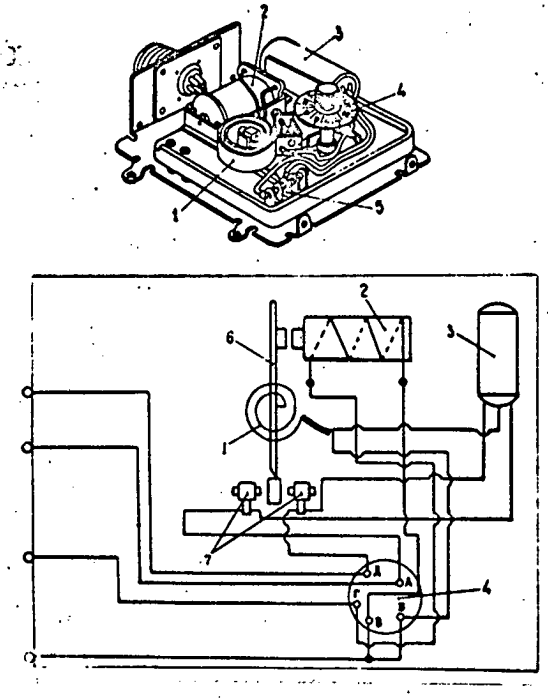


Fig. 85. The TRTVK-45M temperature regulator

1. Bimetallic coil with fastener
2. Feedback electromagnet
3. Spark quenching capacitor
4. Dial
5. Contact panel
6. Moving contact
7. Fixed contact

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The manifold air limit serves for automatic maintenance of the pressure of the air entering the canopy air and foot-heater manifolds. This valve is installed in the cockpit under the flooring and to the left, on frame 7.

The ground air conditioning connection serves for forced cockpit ventilation when the aircraft is on the ground with the engine off and in the event the pilot must remain in the cockpit for a prolonged period.

[p 393]

3. GROUND CHECKING OF COCKPIT PRESSURIZATION

Checking the airtightness of the cockpit is done with the aid of a special Ye6-9820-00 device in the following order:

1. Set the ARD-57 pressure regulator in the "Off" position (the position for ground testing of cockpit airtightness).

2. Close the cockpit air supply valve.

3. Connect the hoses of the ground device to the nipples located in the recess of the nose gear strut. Connect the ground air tank to the device.

4. Close and seal the canopy from the outside.

ATTENTION: The ground device makes it possible to test cockpit airtightness without [the need of] anyone in the cockpit.

5. Open the ground air tank valve and by slowly opening the valve on the device, fill the cockpit with air. Watch the readings of the manometer on the device. The pressure increase rate during this filling should not exceed 0.1 kg/cm^2 per minute.

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6. Bring the pressure up to 0.35 kg/cm^2, shut off the air to the cockpit, and then quickly close the valve on the device and on the air tank. Note the time it takes for the cockpit pressure to drop from 0.3 to 0.1 kg/cm^2.

7. The cockpit is considered to be [sufficiently] airtight if the [p 394] time for the pressure to drop from 0.3 to 0.1 kg/cm^2 is not less than 90 seconds. If the time is less than 90 seconds, find and correct the leak.

ATTENTION: One of the causes of cockpit leakage could be the drying of the lubricants in the aircraft and engine control rod seals. Lubrication of the rods in this case is done as indicated in the chapter "Maintenance Operations," in the section, "Control."

8. Disconnect the hoses of the device and set the ARD-57V valve in the "On" position and lock it. Cap the nipples.

4. CHECKING THE OPERATION OF UNITS OF THE TEMPERATURE REGULATION SYSTEM

1. The 525 Electric Air Distributor Valve

Checking the operation of the electric air distributor is performed with an external electrical power supply in the following order:

a) Turn on the switch marked "Battery, Aircraft, External" and the AZS circuit breaker marked "Cabin Heating" which are located on the right console.

b) Set the 4-position switch of the air supply system in the "cold" position and visually, through the left bottom hatch between frames 20 and 22, check the condition and movement of the distributor valve levers. [p 395] After setting the distributor in the farthermost position, cut-off of the electric mechanism should occur, as can be ascertained aurally.

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c) Set the switch in the "hot" position and visually check the operation of the distributor valve according to the movements of the levers up to cut-off. The total switching time of the valve should not exceed 30 seconds.

ATTENTION: If when the switch is set in the "cold" position and switching of the electric mechanism does not occur (this can be the result of the fact that the valve is already in this position), then it should be reset first in the "hot" position and then in the "cold" position.

Turn off the "Battery, Aircraft, External" switch and the AZS "Cabin Heating" circuit breaker.

2. The TRTVK-45M automatic cockpit air temperature regulator

(To be done in the event of failure of the system)

Checking of the operation of the automatic temperature regulator should be performed with an external power supply in the following order:

a) Turn on the "Battery, Aircraft, External" switch and the AZS "Cabin Heating" circuit breaker which are located on the right console;

b) Open the cockpit air supply valve:

c) If the ambient air temperature is below +16°C, switch the air supply system to cold air feed and then set the 4-position switch in the "Automatic" position.

If the temperature regulator system is functioning properly, the system should switch over to hot air feed. [p 396]

d) If the ambient air temperature is above +16°C, switch the system to hot air feed and then set the switch in the "Automatic" position.

Switching of the system to cold air feed indicates that the air temperature regulator is functioning properly.

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e) Turn off the "Battery, Aircraft, External" switch and the AZS "Cabin Heating" circuit breaker.

ATTENTION: It must be kept in mind that if the ambient air temperature is 16±4° C, the regulator contact might be in a neutral position and switching of the distributor valve may not occur under these temperature conditions. In this event, hot or cold air from an external supply source may be blown over the regulator.

f) Set the cockpit air supply valve in the "Closed" position

3. The 477D turbo-cooler unit

a) A preliminary step in checking the operation of the turbo-cooler consists of turning its rotor by a blade on the turbine. For access to the turbine, it is necessary to open the bottom panel between frames 14 and 16.

The ease of rotor rotation is an indication of the working order of the turbo-cooler. [p 397]

b) With the engine running, a check of the operation of the turbo-cooler is performed as follows. Upon switching the system over to cold air feed, the temperature of the air in the lines leading to the canopy should be 5-15° lower than that of the ambient air (at average humidity). If the air temperature is not less than the ambient air temperature when the cold line is switched in it is necessary to check the freedom of rotation of the turbo-cooler shaft. The absence of any noticeable temperature drop in the "cold" line with the turbo-cooler in proper working order testifies to an inadmissibly high overflow of air from the "hot" line into the "cold" line through the gates of the 525 distributor valve.

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c) After every 50-hours of operation the turbo-cooler must be refilled with OKB-122-14 type oil. Oil in quantities up to 55 grams can be poured into one of the openings designated for this purpose.

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CHAPTER VIII [p 398]

THE COCKPIT CANOPY

1. General Information

The cockpit canopy protects the pilot from the high-speed air stream in flight, provides the necessary visibility, and also provides for the required pressurization.

From the design point of view the operational characteristics of the canopy are as follow.

1. The canopy can be opened and closed for pilot entrance and exit, i.e. the canopy is attached to the fuselage at the front of the cockpit and swings upward and forward. In flight, in case of necessity, the canopy can be jettisoned by means of the emergency control system or, if the pilot leaves the aircraft by the catapault method, it can be separated from the fuselage simultaneously with the pilot's seat.

2. The canopy glasswork consists of the following materials. The majority of the canopy (except for the windshield) is made of a ST-1-grade of organic heat-resistant glass, 10 mm thick. The flat front windshield is made of a transparent armor glass, 65 mm thick, at the sides of which are installed protective glass panels which shield the pilot from the air stream in the event of emergency [or accidental] canopy jettisoning.

3. The canopy has two lock control systems, operational and [p 399] emergency.

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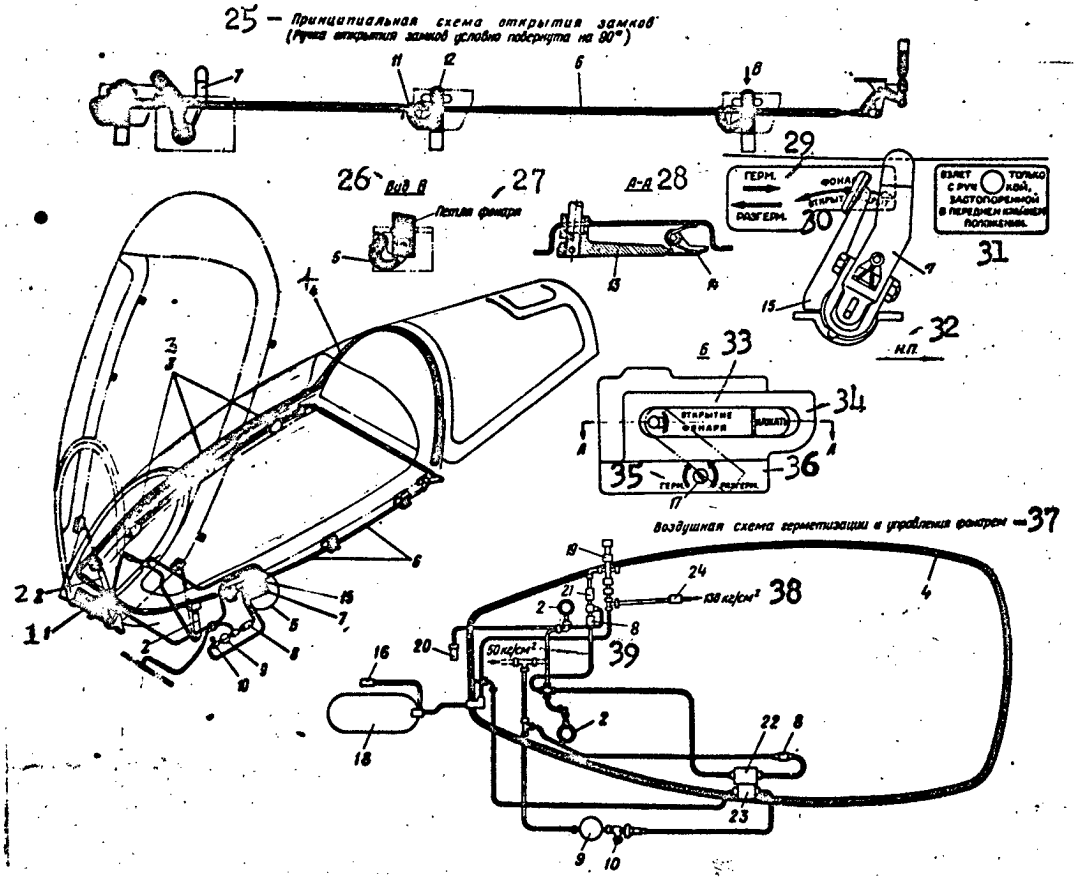


Fig. 86. Canopy control and sealing system.

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Fig. 86. Canopy Control and Sealing System [p 401]

1. Front lock-hinge [assembly] bracket
2. Canopy actuator (opening) cylinders
3. Pin assemblies for attaching the canopy to the fuselage
4. Canopy sealing hose
5. Locking pin limiter (on the left side)
6. Side lock control rod
7. Canopy control lever
8. Check valve
9. RV-1.5 regulator [pressure reducing valve]
10. Safety and check valves
11. Side lock locking pin lever
12. Side lock locking pin
13. Exterior canopy control [opening] handle
14. Exterior canopy control handle retainer button
15. Canopy sealing button
16. [Air] charging connection
17. Exterior canopy sealing and unsealing [screwdriver] slot
18. Emergency air bottle
19. Emergency (diaphragm) valve
20. Delay lock cylinder
21. Fragment filter [trap]
22. Canopy control chamber
23. Canopy sealing chamber
24. Canopy emergency jettison air system check valve
25. Diagram showing the lock opening principle (the lock lever has been turned 90° for convenience of illustration)
26. View along B
27. Canopy latch
28. [View along] A-A
29. SEAL → ← UNSEAL
30. CANOPY OPEN CLOSE
31. LEVER MUST BE LOCKED IN FULL FORWARD POSITION PRIOR TO TAKEOFF
32. Forward
33. OPEN CANOPY
34. PRESS
35. SEAL UNSEAL
36. Air system for canopy sealing and control
37. 130 kg/cm^2
38. 50 kg/cm^2

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[p 402]

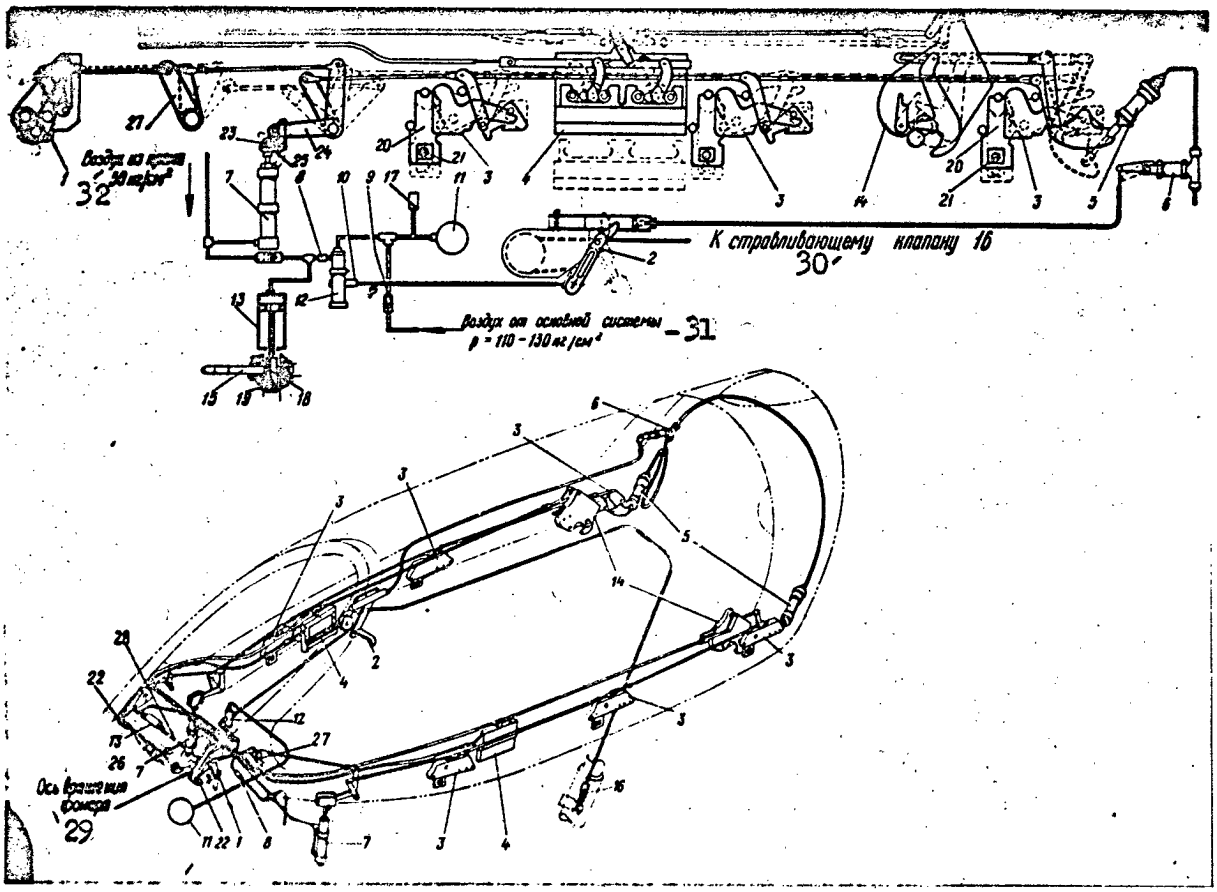


Fig. 87. Canopy emergency jettison system.

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Fig. 87. Canopy Emergency Jettison System [p 403]

1. Front lock-hinge [assembly]
2. Canopy emergency jettison [control] lever
3. Canopy emergency side lock
4. Forward lock-catch [assembly]
5. Canopy lock opening cylinders
6. Initiator [TSM-2500-38 type]
7. Canopy actuator and jettison cylinders
8. Fragment filter [trap]
9. Check valve
10. Diaphragm valve sear
11. Canopy jettison air bottle
12. Diaphragm valve
13. Canopy delay lock cylinder
14. Rear lock-catch [assembly]
15. Canopy delay lock hooks
16. Dump valve locking pin of the TSM-2500-38 initiator
17. Emergency jettison bottle pressure testing connection
18. Canopy delay lock shaft
19. 3520A-2-6-type aluminum shear rivet
20. Side lock latch
21. Pin
22. Canopy attach and pivot axis bolt
23. Canopy and actuator piston rod attach pin
24. Canopy emergency jettison system bellcrank
25. Crescent-shaped hook
26. Hinge assembly with the two front locks
27. Double lever
28. Front lock axis of rotation
29. Canopy axis of rotation [p 402]
30. To dump valve 16
31. Air from the utility system, p = 110-130 kg/cm^2
32. Air from the valve, 50 kg/cm^2

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The canopy operational control system is used to open and close the canopy, seal the cockpit, and for attaching the canopy to the fuselage.

The emergency control system provides for independent emergency jettisoning of the canopy (not jointly with the seat), separation of the canopy from the fuselage when ejecting with the canopy as protection, and for separation of the canopy from the seat after ejection.

Use is made of only rigid control rods to the locks which hold the canopy to the fuselage and also to the hooks which connect the canopy to the seat during ejection. The location and operating principles of these locks are given below.

On the fuselage within the canopy sill are located six pin assemblies 3 (Fig. 86) which are controlled through a system of rods by the lever 7 on the left side of the cockpit (the operational control system).

In the frame of the canopy, and in line with the pin assemblies in the fuselage, are installed six side emergency locks 3 (Fig. 87) which open during emergency jettisoning of the canopy.

As the canopy is lowered, the drop latches 20 of these locks (which are common control elements of the operational and emergency systems) enter the notches in the pin assemblies. When the lever 7 (Fig. 86) is moved forward, these latches are locked by the pins 21 (Fig. 87), forming a tight coupling between the canopy and the fuselage.

When lever 7 (Fig. 86) is moved aft, the pins move out of [p 404] the latches, freeing the canopy.

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The canopy emergency jettison locks 3 (Fig. 87) are interconnected within the canopy frame by a system of rods and rocking arms which are actuated by the pressure of powder gases from the cartridge 6 which fires when the canopy emergency jettison lever 2, located on the right side of the canopy, is moved aft (the emergency control system).

As the emergency control system cycles, the locks 3 open, freeing the latches 20, which, after dropping from the locks 3, remain on the pins 21 in the notches of the canopy sill. It is in this manner that the canopy is freed from its tight coupling with the fuselage.

Pivoting of the canopy as it opens (rises) occurs about the forward bracket, attached to the fuselage, by which the canopy is connected by two locks (right and left) which are installed on the hinge assembly 26 of the canopy. These locks, which are of the hinged type, are always closed during operation and open only during cycling of the canopy emergency jettison system simultaneously with the side locks 3, freeing in this case the bolt 22 and thus breaking the coupling between the canopy and fuselage.

4. Opening (raising) and closing (lowering) of the canopy is accomplished by its pivoting about the forward hinge assembly, to an angle of approximately 45°.

Canopy opening is initiated by the two actuator cylinders 7 (right and left), the piston rods of which are connected to the canopy by special pins with crescent-shaped hooks and the fastening units on the fuselage. [p 405] The cylinders in turn are attached by hinged joints to the fuselage.

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The upper ends of the crescent-shaped hooks 25 enter the notches of the bellcrank 24 of the canopy emergency jettison system (with the system in the closed position) and the pins 23 of the actuator piston rods are connected to the canopy.

During cycling of the canopy emergency jettison system, the bellcranks 24 will turn and free the crescent-shaped hoods which in turn will free the piston rod pins of the canopy actuator cylinders. Air under a pressure of 50 kg/cm^2 is fed to these cylinders from the aircraft utility air system.

Canopy closing takes place under the action of its own weight. At the same time, air is dumped from the cylinders and out of the aircraft.

5. Closing and opening of the canopy is controlled by valve 22 which is installed on the left side in the cockpit and which permits air to flow into the actuator cylinders during canopy opening and dumps the air during closing.

This valve is activated by a lever which is hinged on a shaft on which a gear segment is secured. The teeth of the segment mesh with a gear wheel which is attached on the valve shaft. On the shaft of the valve control lever is another lever which is connected by rods to all six of the pin assemblies "3" which lock the latches of the canopy side locks.

In the "Canopy closed" position (forward position), the valve lever enters a notch in the valve panel under the action of a spring and in this manner is blocked from moving aft. In this position of the levers,

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the locking pins 21 (Fig. 87) enter the latches 20 of the canopy side locks and lock the canopy, whereas the air-supply valve to the actuator cylinders and the valve for dumping air from the cylinders are closed. [p 406]

In order to move the valve lever in the direction for opening the canopy, it is first necessary to deflect the lever away from the side to bring it out of the valve panel notch and, by moving aft, open the canopy. In this case, when the lever has traveled approximately 60°, the pins in the latches of the canopy side locks will be withdrawn and with another 15° of travel, air will enter from the utility air system through the valve and into the actuator cylinders.

Entrance of air into the actuator cylinders begins after displacement of the lever 3-8° from the position corresponding to full withdrawal of the pins from the latches of the side locks. This eliminates the possibility of premature accumulation of air in the cylinders and a sharp opening of the canopy after the pins have withdrawn from the latches.

When moving the valve lever in the direction for opening the canopy (forward), the valve lever is blocked in the vertical position (45° travel) and then air is dumped from the cylinders through the valve and out of the aircraft.

After the canopy has lowered completely, when the latches of the locks enter the notches in the canopy sill and the rear left latch depresses the spring limiter "5" (Fig. 86) of the locking pin, further forward movement of the valve lever up to the "CANOPY CLOSED" position will be possible, whereby the locking pins will enter the latches of the canopy side locks and the valve lever will enter the notch in the panel and lock.

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Locking of the lever in any intermediate position by the spring limiter 5, in which the end of the left rear pin is butted against prior to the arrival of the left rear lock latch at the limiter, eliminates any posibility of taking off in an aircraft with the side locks not locked.

Opening and closing of the canopy is possible from outside the aircraft. For this purpose, the valve lever shaft is brought through a seal and out to the outer skin and a handle (exterior) is attached at this end of the shaft. With the canopy closed, this handle is retracted flush with the skin of the fuselage. [p407]

Operation of the valve during opening and closing of the canopy using the exterior handle proceeds in the same manner as when using the lever within the cockpit.

For smooth opening and closing of the canopy, throttle orifices have been made in the valve (on the valve input and on the dump line). These make it possible to open the canopy in 3-5 sec and close it in 5-10 sec.

In a case when it is necessary to open the canopy from the outside, when there is no pressure in the aircraft air system, on the left side and to the rear of the canopy there is still another recessed handle with which it is possible to raise the canopy. In this case the canopy locks must be opened by the exterior handle marked OPEN CANOPY (Fig. 88).

6. An air-tight joint between the canopy and fuselage is accomplished by means of a shaped rubber hose which is filled with air at a pressure of 1.7-2.55 kg/cm^2 from the utility air system of the aircraft (Fig. 86). The rubber hose is fitted to the canopy sill and about the rim of the air-tight partition (to the rear) in a special channel.

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[p 408]



Fig. 7. Exterior canopy control [opening] handle (left). At the right is a lever for raising the canopy when there is no air pressure in the system [interior canopy emergency control lever].

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Filling of this hose with air is done through the same valve with which opening and closing of the canopy is accomplished. This valve has a second chamber 23 with a separate input tube from the utility air system for the hose.

The button 15, by means of which air is fed to and dumped from the [p 409] hose into the atmosphere, is attached on the common shaft with the canopy control lever and connects with the valve shaft by means of a gear wheel.

Sealing of the canopy (filling the hose with air) is performed only with the canopy locked. This is accomplished by moving the button forward (away from oneself).

Unsealing [depressurization] of the canopy (dumping air from the hose) is performed before opening the canopy. This is accomplished by moving the button aft (toward oneself).

To save time and motion, unlocking of the canopy and its depressurization are performed by one movement of the valve lever toward oneself. In this case the button moves along with the valve lever.

For the purpose of opening the canopy from the outside, the valve shaft is brought through a seal and up flush with the fuselage skin. On the outward end of this valve shaft is the groove 17 (see Fig. 86) for a screwdriver. Air for filling the hose enters from the utility air system through the RV-1.5 pressure reduction valve (position 9), through the safety and check valves 10, and then through the valve and into the hose 4.

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7. In flight, in case of an emergency, the canopy can be jettisoned. For this purpose (as indicated above), on the canopy and fuselage there is mounted an emergency canopy jettison system (emergency lock opening) which provides forced jettisoning of the canopy by compressed air at a pressure of 110-130 kg/cm^2.

Installed on the right side of the cockpit is a folding-type lever for activating the canopy emergency jettison system.

The canopy emergency jettison system cycles in the following order.

Upon opening the lever 2 (Fig. 87 to an angle of 45°, the cable, which connects the lever with the pin 10 of the diaphragm valve 12, pulls out this pin, as the result of which the striker 4 (Fig. 89) is [p 410] released and punctures the diaphragm 3.

Air from the emergency bottle 11 (Fig. 87), which is cut off from the utility air system by the check valve 3, enters the canopy actuator cylinders 7, readying the canopy for jettisoning, and into the cylinder 13 for opening the delay lock, the piston rod of which, after shearing the rivet 19, drives out the shaft 18 and opens the lock 15.

When turning the folding lever of the canopy emergency jettison (system) through an angle of approximately 75°, the lug on it is disengaged and the lever can now be moved aft.

When the lever is moved aft (toward oneself) a distance of 20-30 mm, the lower end of the lever, which enters the release drive notch on the canopy, deflects the plunger of the drive which is connected by a cable with the release lever of the initiator and activates the initiator 6 (Fig. 87).

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[p 411]

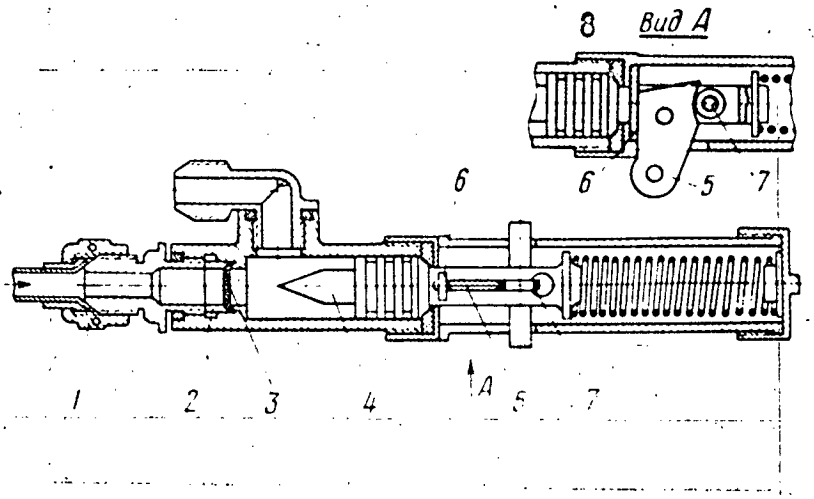


Fig. 89. Diaphragm (emergency) valve.

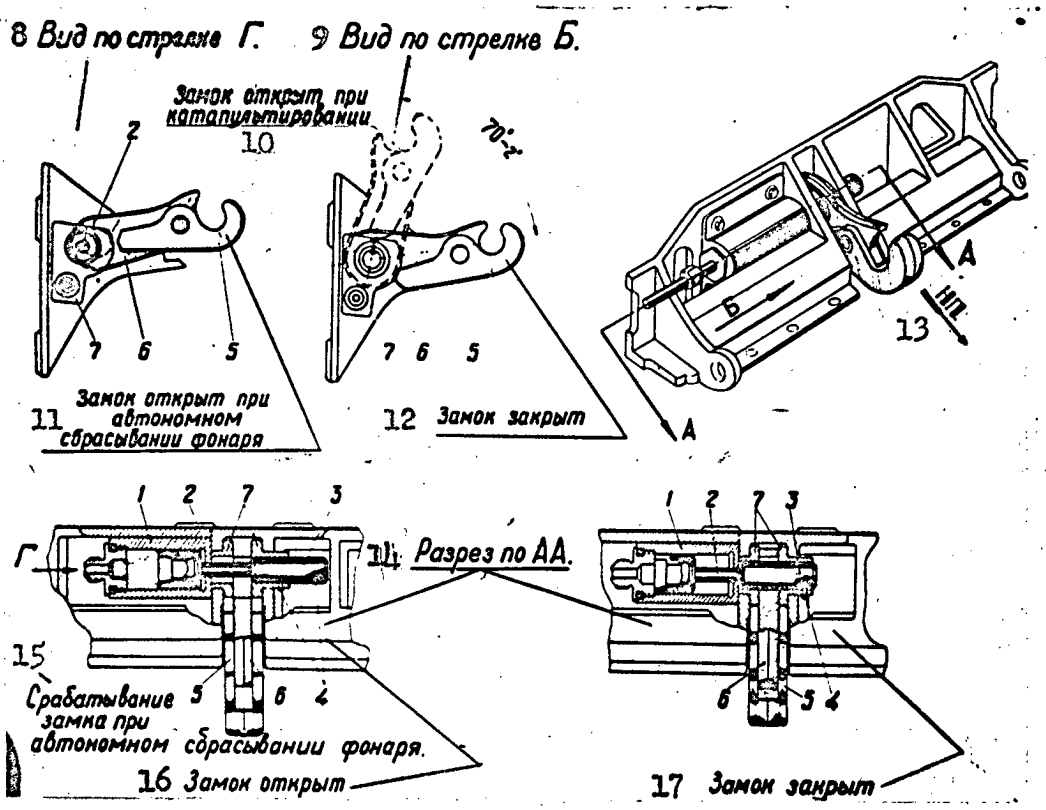
1 - Coupling nut
2 - Insert with bonded diaphragm
3 - Diaphragm
4 - Striker
5 - Sear
6 - Floating washer
7 - Roller
8 - View [along] A

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[p 412]

Fig. 90. Canopy delay lock.

[p 413]

1 - Air cylinder
2 - Piston with rod
3 - Lock shaft
4 - 3520A-2-6-type aluminum shear rivet
5 - Hook
6 - Jaw
7 - Double flanged bushing
8 - View along arrow Г
9 - View along arrow Б

[p 412]

10 - Lock is opened when the pilot's seat is ejected
11 - Lock is opened when the canopy is jettisoned separately
12 - Lock open
13 - Forward
14 - Section along AA
15 - Lock cycling when the canopy is jettisoned separately
16 - Lock open
17 - Lock closed

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The pressure from the powder gases of the initiator is transmitted into the two actuator cylinders 5, the piston rods of which, upon displacement, open the six side emergency locks 3 and the two locks 1 of the front hinge assembly through a system of rocking arms and rods.

The two bellcranks 24 free the crescent-shaped hooks 25 which connect the canopy actuator cylinders and the canopy is jettisoned upward by the pressure of the air transmitted to the cylinders from the emergency [air] bottle.

With further movement of the handle aft, valve 16 is opened (dumping the powder gases from the TSM-2500-38-type [cartridge] initiator, i.e. the locking pin is jerked from the valve (see Chapter 1X)).

NOTE: If one of the [cartridge] actuators fails, the system will [p 414] function reliably with the other. For this purpose, the right and left springs of the emergency jettison locks are interconnected by a common shaft to which the levers of the forward locks of the canopy are attached.

In the closed position the movable units of the canopy emergency system are safetyed as follows (Fig. 91):

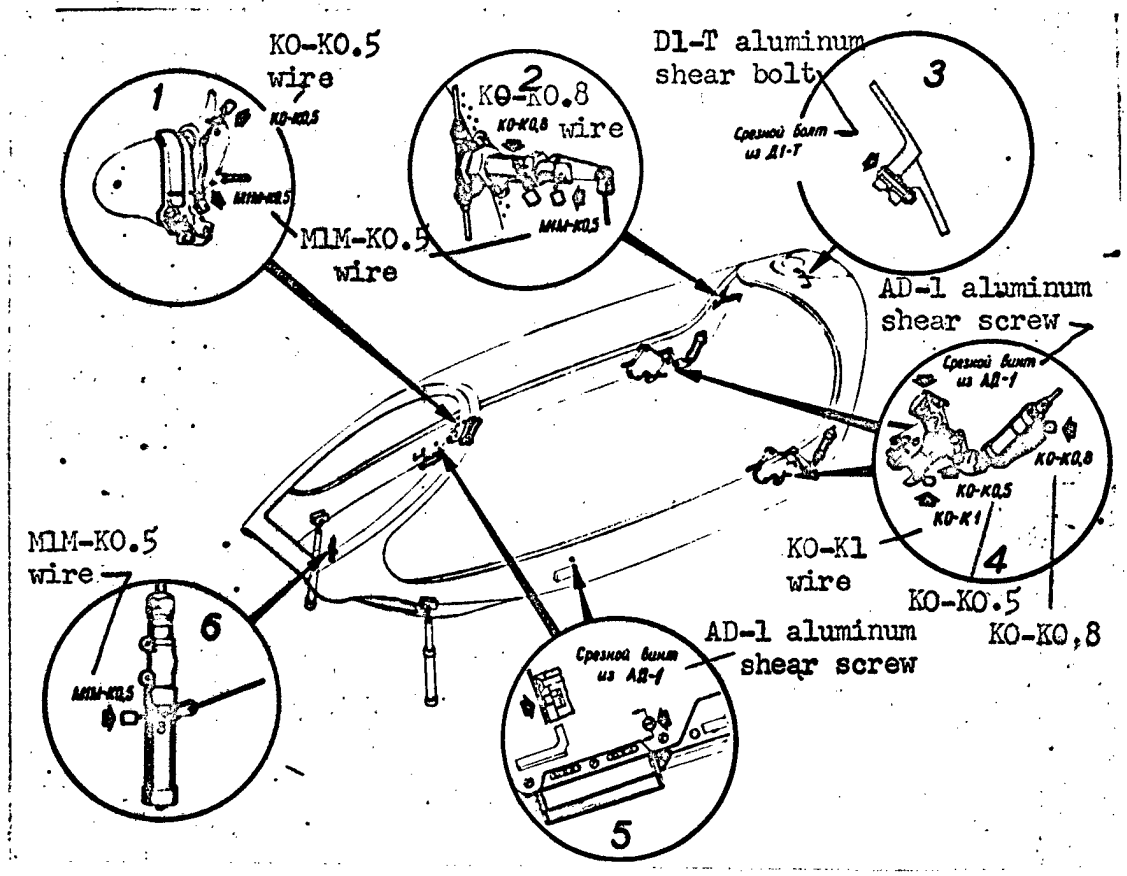
- the folding lever 1, with M1M-KP.5 wire;
- the canopy initiator trigger drive lever on the independent jettison lever 1, with KO-KO.5 wire;
- the canopy initiator pin 2, with M1M-KO,5 wire;
- the rear canopy emergency jettison control system levers at the actuator /gas/ cylinder 4, with KO-KO.5 wire;
- the diaphragm valve lock 6, with M1M-KO.5 wire.

The closed position of the canopy locks is checked (in addition to checking for the presence of the above-indicated safety wires) according to the position of the crescent-shaped hooks 25 (Fig. 87) of the actuator

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[p 415]

Fig. 91. Safetying of canopy mechanisms.

[p 416]

1 - Canopy emergency jettison lever
2 - Initiator
3 - Seat stabilizing parachute ejection hatch
4 - Rear lock-clamp with actuator cylinder [powder gas driven]
5 - Forward lock-catch [assembly]
6 - Diaphragm valve

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[p 417]

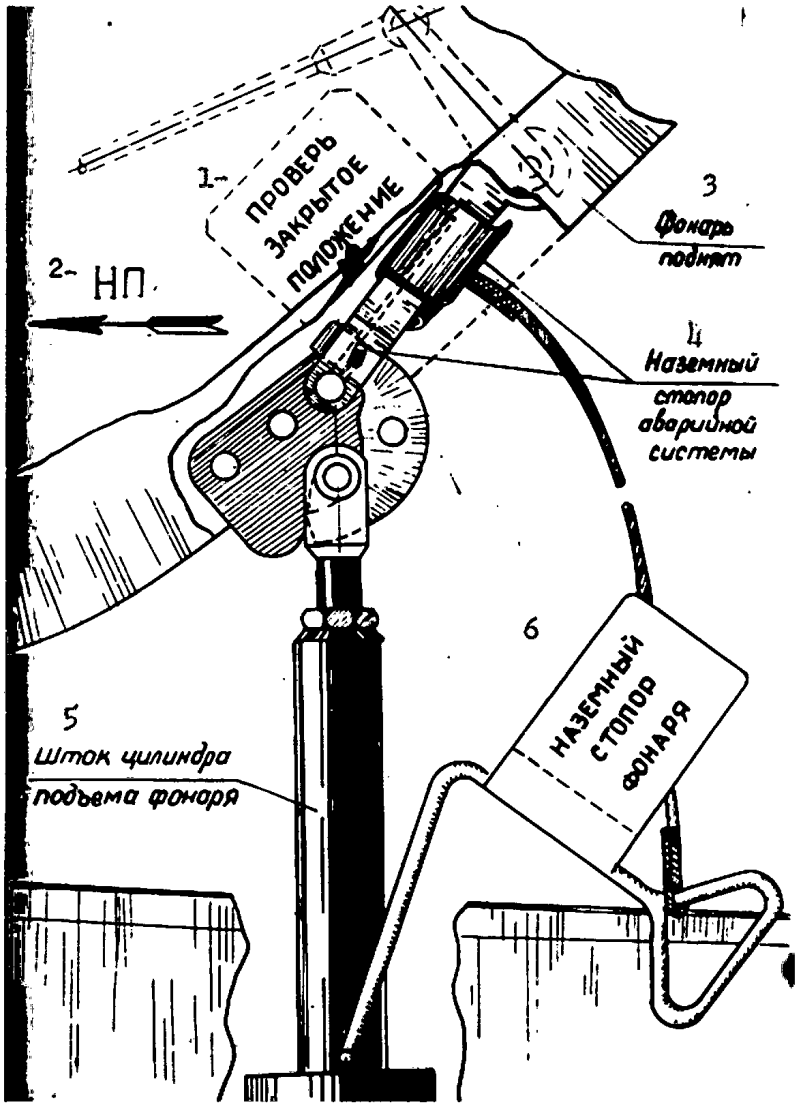


Fig. 92. Installation of the ground safety pin.

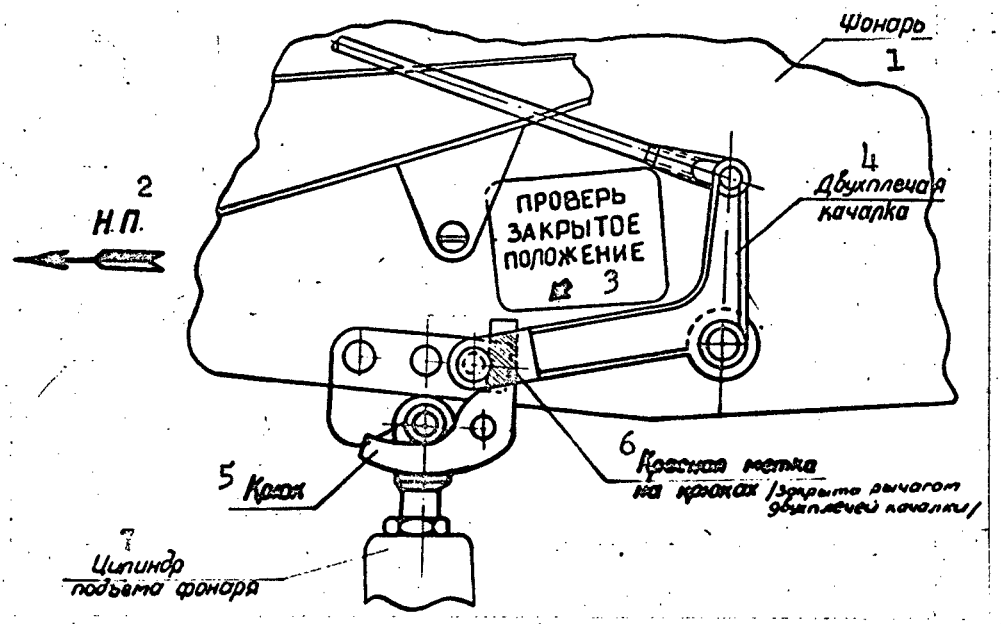
1 - CHECKED THE LOCKED POSITION
2 - Canopy raised
3 - Forward
4 - Emergency system ground safety pin
5 - Canopy actuator cylinder piston rod
6 - Canopy ground safety pin

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[p 418]

Fig. 93. Checking the locked position of the canopy emergency jettison system (view from the right side).

1 - Canopy
2 - Forward
3 - CHECK THE LOCKED POSITION
4 - Bellcrank
5 - Hook
6 - Red mark on the hooks (covered by the bellcrank arm
7 - Canopy actuator cylinder

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cylinder piston rods relative to the notches on the bellcranks 24.

This position is checked in accordance with the following:

a) by the red markings on the cylinder piston rod hooks -- the hooks should enter into the notches of the bellcranks in such a way that the painted surfaces of the hooks are completely concealed within the notches of these cranks (Fig. 92);

b) by the alignment of the openings in the left hook of the piston rod and the bellcrank by inserting a ground safety pin through the indicated openings of the rocking arm and hook (Fig. 93)

Besides its checking function, this safety pin serves for locking /p 419 the system in the closed position thereby preventing it from shifting and should be installed each time after opening the canopy simultaneous with the installation of a ground safety lock in the piston rod of the left canopy actuator.

8. On the canopy are installed front and rear lock-catches which are designed for joining the canopy to the seat when ejecting with the canopy for protection (see Chap IX).

The forward lock-catch units 4 (Fig. 87) are installed on the right and left sides of the canopy and during ejection engage with the cam latch on the side of the seat.

The rear lock-catch units 14 are also installed on the right and left sides of the canopy in line with the rear side locks and during ejection engage with the pins on the seat.

To prevent the front portion of the canopy from moving upward /prematurely/ (during ejection) and to ensure reliable attachment of

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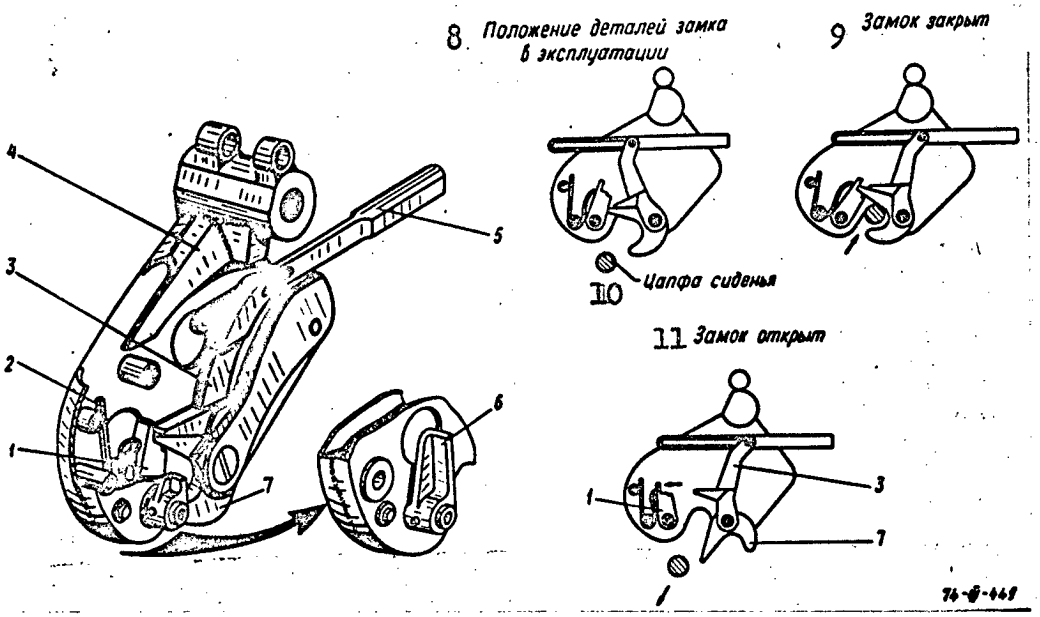


Fig. 94. Rear lock-catch [assembly]

1 - Detent
2 - Spring
3 - Lever
4 - Housing
5 - Push-pull rod
6 - Dog
7 - Catch
8 - Position of lock parts in various operational stages
9 - Lock closed
10 - Seat pin
11 - Lock opened

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the canopy to the seat, on the fuselage is installed a delay lock (Fig. 90) which opens when the canopy turns the lock through an angle of approximately 70°. On the front hinge assembly are installed two rollers which are designated for moving the canopy over the armor glass during the initial moment of ejection with the canopy for protection.

During ejection with the canopy for protection, the pins of the seat, when the seat has moved up a distance of 20 mm, enter into the rear lock-catch units (Fig. 94) and are locked in them.

Simultaneously, all of the emergency locks 3 and 1 (Fig 87) are opened by the rod 7 [sic] and the canopy is freed from all connections with the fuselage, with the exception of the delay lock (Fig. 90).

With further movement of the seat upward together with the canopy, the delay lock is turned and the canopy is freed from it when the lock has turned through an angle of 70°, whereby the canopy begins to move over the armor glass on its rollers 7 (Fig. 95). [p. 422]

At the moment the seat has left the cockpit, the spring-loaded cam latches, by which the canopy is engaged by the forward lock-catch assemblies after is rolls off the armor glass, open (see position 4 in Figs 86 and 87).

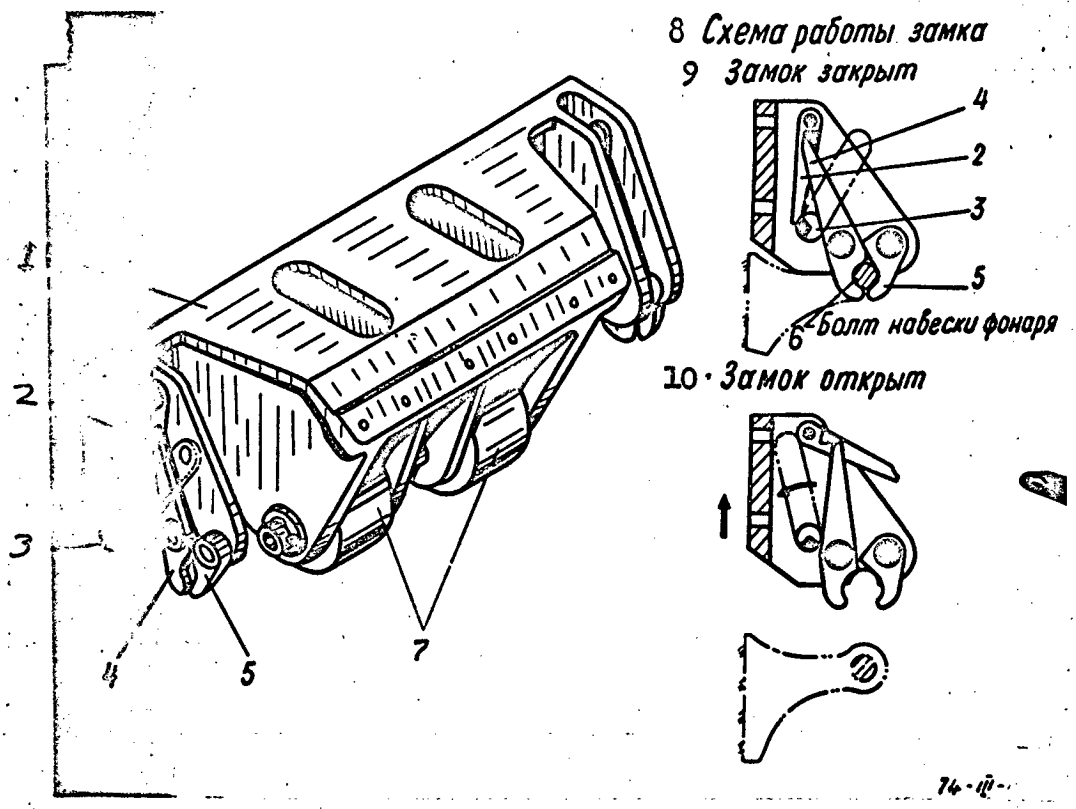
Detaching of the canopy from the seat occurs during firing of the 215F cartridge mechanisms which turn the bellcranks on the seat (see Chap IX). These levers, upon depressing the dogs 6 (Fig. 94) mounted on the rear lockcatch units, open the forward lock-catch units 4 (Fig. 87) by a system of rods. The clamps of these forward lock-catch units, upon falling from locks, free the canopy from the cam catches on the seat.

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[p 423]

Fig. 95. Front lock-hinge [assembly].

1 - Bracket
2 - Locking lever
3 - Rocking arm with rod sector
4 - Large clamp
5 - Small clamp
6 - Canopy attach bolt
7 - Rollers
8 - Diagram of lock operation
9 - Lock closed
10 - Lock open

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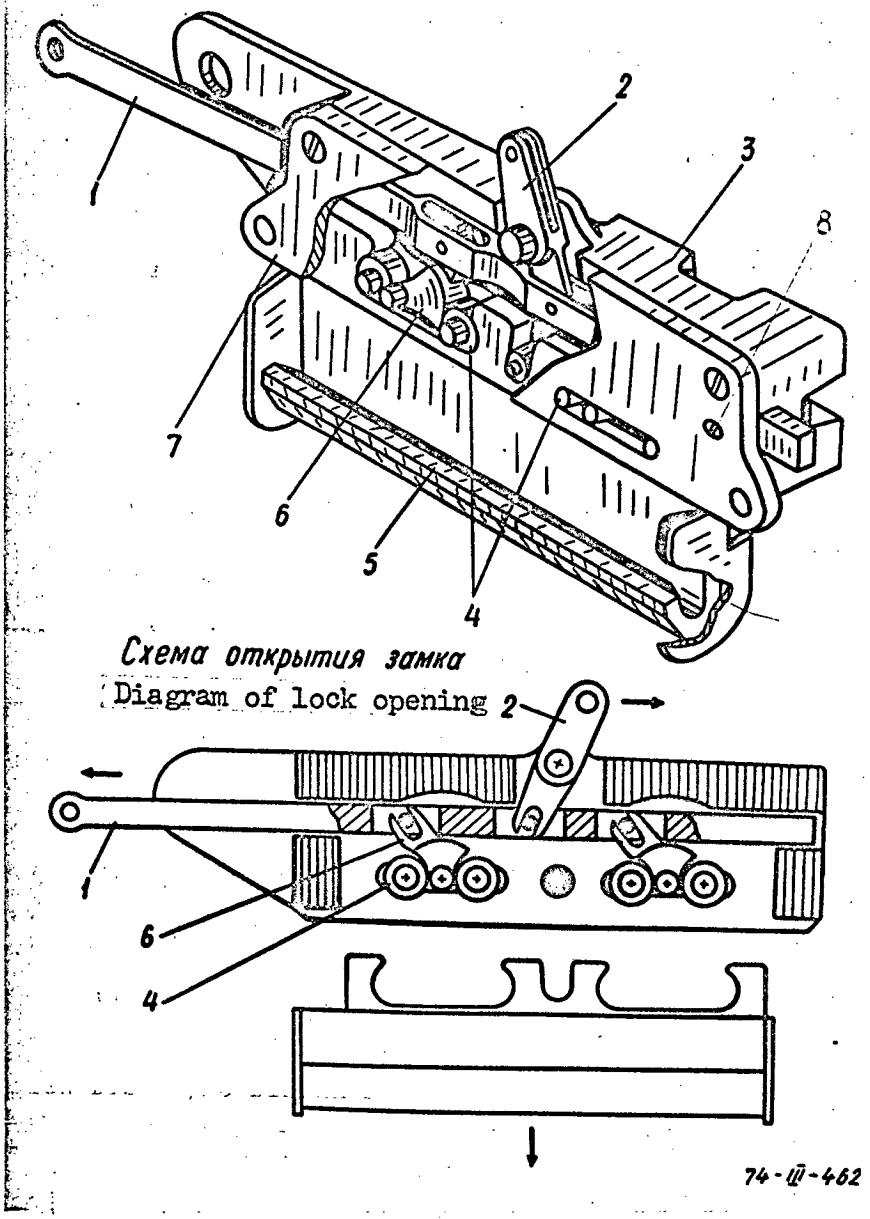


Fig. 96. Forward lock-catch [assembly]

1 - Rod
2 - Drive rocking arm
3 - Housing
4 - Roller
5 - Catch
6 - Dog
7 - Cover [plate]
8 - Shear screw

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For synchronous disconnection from the seat and doubling in case one of the 215F firing mechanisms fails, the catches of the forward locks are interconnected by a double cable drive.

Under the action of the forces from the 215F firing mechanisms, which turn the canopy about the pins on the seat, and also the airsteam, the canopy swings up and exposes the pilot.

When the canopy turns through and angle of approximately 110°, the dogs 6 (Fig. 94) on the rear lock-catch units come in contact with the cams on the seat pins, are depressed by them and open the rear lock-catch units, completely freeing the canopy from any connection with the seat.

9. On the front windshield is installed a vented manifold of [p 425] the alcohol anti-icing system. Maintenance of the anti-icing system and the glasswork of the canopy is covered in Section 8 of this chapter.

10. A blower manifold is installed on the canopy for heating the cabin and canopy glasswork under icing and fogging conditions.

Upon closing the canopy, the nipple of the manifold connects with the cockpit pressurization line.

Operational and maintence procedures for the canopy are presented below.

2. General Information on Canopy Operation

1. Considering the fact that the canopy control systems are elements which provide for reliable operation of safety facilities for the pilot, only those persons who have been checked out on their construction and operation should be permitted to operate them.

2. A daily check should be made of the condition of the assemblies and parts of the emergency systems and for the presence of safety locks

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and seals, keeping in mind that the presence of the safety locks and seals testifies to the proper condition of the canopy emergency jettison system but that they should not be elements which would interfere with the movement of the rods and rocking arms.

3. To prevent any accidental displacement of the rods of the canopy emergency jettison system in the direction for opening, or throwing the canopy emergency jettison lever during ground servicing of the aircraft, it is necessary to install ground safety pins in the openings of the bellcrank and hook of the canopy actuator piston rod (on the left side) [p42 jointly with the safety pins for the piston rod of the left cylinder and in the canopy emergency jettison lever (Fig. 92).

These safety pins should be installed immediately after the canopy has been opened and should be removed to close the canopy prior to take-off.

4. To prevent accidental release of the striker in the diaphragm valve when performing any operations in the zone in front of the instrument panel, a ground safety pin must be installed in the diaphragm valve and removed immediately after the completion of said operations.

5. To prevent any accidental firing of the initiators of the emergency jettison system when removing or installing the canopy on the aircraft or when performing maintence on it, a ground safety lock must also be installed and removed upon completion of these operations.

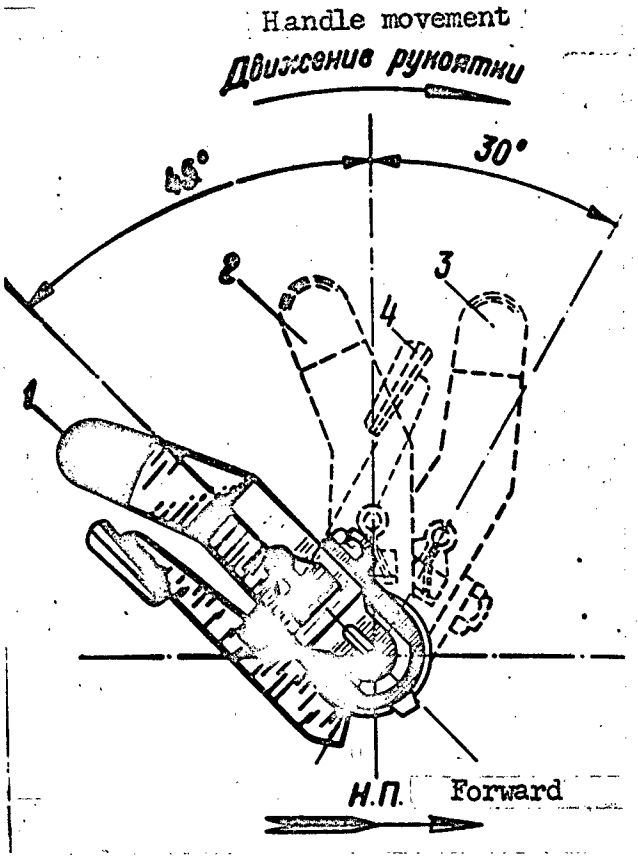
6. To prevent any mechanical damage to the glasswork of the canopy and to protect it against the action of sunlight when the aircraft is parked, the canopy should be covered with a baize jacket.

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[p 427]

Fig. 97. Operation of the canopy control valve and locks when the lever is moved forward (to close the canopy). [p 428]

1 - Canopy is in the raised position. When the lever is moved to position 2, air is dumped from the canopy actuator cylinders and the canopy lowers.

2 - The lever is blocked [in this position] prior to complete lowering of the canopy and the locking pin limiter is depressed. When the lever is moved to position 3, the latches of the side locks are locked by pins.

3 - Canopy is completely lowered, the latches of the side locks are held by the pins but the canopy is not [as yet] sealed. When the button is moved to position 4, the sealing hose is filled with air.

4 - Canopy is sealed.

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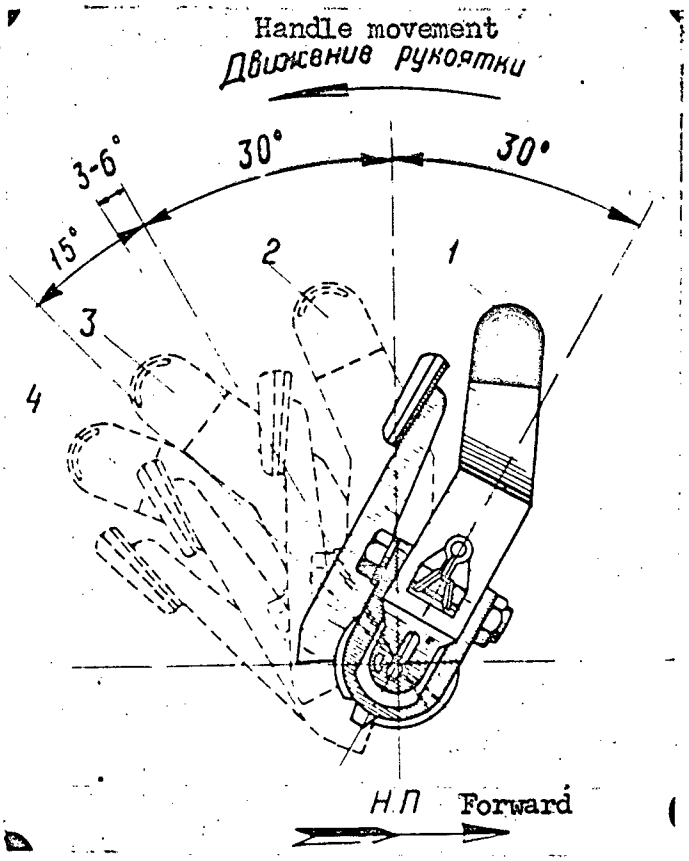


Fig. 98. Operation of the canopy control and sealing valve when the lever is moved aft.

1 - Canopy is closed and sealed. When the lever is moved jointly with the button to position 2, the canopy is unsealed [depressurized].

2 - Canopy is unsealed. When the lever is moved from position 2 to position 3, the locking pins are withdrawn from the latches of the side locks.

3 - Canopy is not [as yet] raised, but the locking pins have been withdrawn from the latches of the side locks. When the lever is moved from position 3 to position 4, the canopy rises (air enters the actuator cylinders). The segment 3-6° denotes the portion of free lever travel which is designed for eliminating the possibility of premature accumulation of air in the actuator cylinders before the pins have been withdrawn from the latches of the side locks.

4 - Canopy is raised.

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3. Opening and Closing the Canopy

Opening (raising) and closing (lowering) of the canopy from the outside is performed by means of a lever located on the left side of the fuselage in a special recess marked **OPEN CANOPY**, and from inside the cockpit, by a lever located on the left side of the fuselage marked **CANOPY**; OPEN, CLOSE (Figs 88, 97 and 98).

To open the canopy from the outside the following must be done: [p 430]

1. Free the lever from the recess on the fuselage by pressing the button marked **PRESS**; by doing this the lever will come out of the recess.

2. Move the lever downward from the horizontal position in the direction of the arrow until it stops; in doing this the canopy will become unsealed, the pins will move out of the latches of the side locks and air will enter into the canopy actuator cylinders.

3. After the canopy has been opened, install the ground safety pins in the opening on the piston rod of the left cylinder and in the openings of the bellcrank and hook on the left side.

The canopy can be closed by moving the exterior lever in the opposite direction, after having removed the ground safety pins.

Opening of the canopy from the cockpit should be performed in the following sequence (Fig. 98):

1. Unlock the valve lever by releasing it from the notches in the valve panel.

2. Move the lever toward oneself in a single motion and set it in [p 431] the extreme aft position, whereby unsealing and opening of the canopy will occur in the same sequence as with the exterior lever.

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3. After the canopy has opened, install the ground safety pins as indicated above.

Closing of the canopy is performed in the following sequence (Fig. 92):

1. Remove the ground safety pin from the piston rod of the left canopy cylinder and from the bellcrank of the emergency jettison system.

2. Turn the valve lever away from oneself to the vertical position "Stop"-2, whereby air is dumped from the cylinders. With further movement of the lever away from oneself, it will be stopped before full closing of the canopy. As the canopy lowers and the rear left latch depresses the limiter "5" (Fig. 86) of the locking pin, further forward movement of the lever will then be possible.

3. Move the lever to the extreme forward position, whereby the latches of the canopy side locks will be locked by the pins, after which the lever will be deflected by the spring and enter the notches in the valve panel.

4. Seal the canopy by moving the button into its forward position.

ATTENTION: 1. Takeoff is permissible only with the lever locked in the forward position, i.e. the lever should be in the notches of the panel.
2. When opening the canopy the lever should be moved from the forward to the aft position in one continuous movement.

4. Removal and Installation of the Canopy [p 432]

To remove the canopy from the aircraft, do the following:

1. Open the cover on the forward upper hatch on the fuselage.

2. Open the canopy, install the ground safety pins in the piston rod of the left cylinder and the left unit of the bellcranks of the canopy emergency jettison system and make certain that the required ground safety pins are in the independent canopy jettison lever and the ejection seat mechanisms.

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3. Install the ground safety pin in the canopy initiator.

4. While holding the canopy up manually, remove the pins 23 (Fig. 87) from the piston rods of the canopy actuator cylinders.

5. Sit in the cockpit and lower the canopy by moving the canopy control valve lever to the vertical position (the canopy locks are not closed), but do not seal the canopy.

6. Disconnect the rubber hose of the canopy anti-icing manifold from the tube on the left side.

To avoid crumpling of the manifold, remove it from the canopy after removing the fastening screws.

7. Remove the safety wires, unscrew the nuts and extract the two bolts 22 for attaching the movable portion of the canopy from the forward locks of the hinge assembly.

8. Raise the canopy a little from the inside and after shifting it aft a little to open the delay lock, extract the roller shaft from the delay lock and carefully remove the canopy from the aircraft.

9. Installation of the canopy is performed in the reverse order, [p 433] however, first make certain that the canopy emergency jettison system is in the extreme closed position.

Prior to installing the canopy, turn the delay lock up 70°, after which insert the roller shaft in the jaws of the lock and, while holding the hook of the lock up, line up the holes in the forward hinge-lock assembly on the canopy with the bolt openings in the bracket on the fuselage and insert the bolts 22 after first lubricating with TsIATIM-201 grease.

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The bolts should fit into the locks freely by hand and not require hammering.

WARNING: 1. Placing a canopy removed from an aircraft on the bare ground is prohibited. It is recommended that the canopy be placed with the latches pointing downward with the bottom surfaces of the frame resting on supports. It is permissible to place it with the glass downward if it is set in a shaped shell lined with rubber.

2. A canopy which has been removed from an aircraft must be covered with a jacket to protect the locks against moisture and dirt.

10. When a canopy has been installed on an aircraft, a complete check must be of emergency system locking as follows:

a) install a ground safety pin in the left unit connecting the piston rod of the actuating cylinder with the canopy (i.e. check the alignment of the opening in the bellcranks and piston rod hook);

b) make certain that the red marks on the piston rod hooks do not [p 434] appear outside of the forks of the bellcranks;

c) make certain that all safety wires and seals of the canopy emergency system are in place and also check to see that the red marks on the locking hooks of the rear lock-catch units line up with the marks on the lock housings;

d) Make certain that when the canopy is locked the upper end of the canopy emergency jettison lever rests in the notch on the trigger drive rod of the [cartridge] initiator on the canopy. In addition, make absolutely certain that the emergency lever on the fuselage is in the extreme forward position and locked and that the trigger drive on the canopy is in the extreme rear position.

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5. Checking the operation of the /cartridge/ initiator, the diaphragm valve of the canopy emergency jettison system and the dump valve of the TSM-2500-38 firing mechanism

This check is made whenever any maintenance work is performed simultaneous with maintenance work on the seat.

It is performed with the independent canopy jettison lever in the following order:

1. Open the canopy and, after having installed the ground safety pin in the piston rod of the actuator and in the unit of the left rocking arm of the canopy emergency jettison system, make certain that all ground safety pins are installed in the seat and canopy mechanisms.

2. Unload the canopy initiator, disconnect the tubing from the initiator, cap the initiator tube connections, load the initiator with two IV-1-type blank cartridges and install the ground safety pin.

3. Drop the pressure in the utility air system and the canopy jettison bottle to zero by means of the plug located in the notch on the nose gear strut.

The air is released with the aid of a special 72-7804-250/A device. Air pressure is checked by the manometers in the cockpit and on the device.

4. Recharge the canopy jettison bottle with compressed air to a pressure of 40-50 kg/cm^2 using the same device.

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After recharging the canopy jettison bottle, check the pressure by the manometer of the utility air system. This should be zero and shows [p 435] that the check valve 24 is airtight (see Fig. 86).

The pressure according to the manometer on the device should not drop. This will indicate that the check valve of the jettison system is air tight.

5. Climb in the cockpit, remove the ground safety pins from the rods of the canopy actuator cylinders and safety pins of the emergency system (on the left emergency jettison bellcrank), lock the canopy but do not seal it.

6. After removing the ground safety pin from the canopy emergency jettison lever, turn the lever down until it stops (in a horizontal position).

Upon doing this the diaphragm valve will cycle and air from the emergency bottle sill pass through it into the canopy actuator cylinders and into the cylinder of the delay lock, the piston rod of which shears the aluminum rivet and strikes out the pivot shaft of the lock hook.

7. Pull the canopy jettison lever sharply toward oneself until it comes to a stop. This breaks the safety wire on the lever of the initiator trigger drive.

When the lever is moved 20-30 mm, the primers in the blank cartridges of the initiator are fired.

Upon further movement of the lever, the valve for dumping the powder gases from the TSM-2500-38 firing mechanism is switched in, i.e. the valve safety pin is pulled.

After the pin has been pulled from the valve of the initiator the lever should be free to move at least another 4 mm.

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8. Drop the air pressure in the canopy jettison system to zero using the 72-7804-250/A device.

WARNING: Do not attempt to open or close the canopy until the pressure in the canopy jettison system has been released. [p 436]

9. Remove the canopy from the aircraft in accordance with the section "Removal and Installation of the Canopy", making certain that the delay lock is opened, i.e. the latch of the lock opens easily.

10. Restore the canopy emergency jettison system to working order by doing the following:

a) Disconnect the tubing from the diaphragm valve and filter. Unscrew the tubing connections from the latter and check the diaphragm. If it is ruptured, remove the sleeve 2 (Fig. 89) in which it is held and remove the diaphragm pieces from the valve and the filter.

c) Return the canopy emergency jettison lever to its original position and make certain that the cable leading from the lever rides in the grooves of the rollers and is covered by the shields to prevent it from falling out of the grooves.

d) Using the special 74-7804-300/A device, insert the striker 4 and set the sear 5.

Safety the latch in accordance with Fig. 91 and install the ground safety pin.

WARNING: Pay particular attention to the installation of the sear. The sear should be installed between the roller 7 and the floating washer 6 with its straight side toward the floating washer (Fig. 89, view along arrow A. Non-observance of this requirement could result in self-induced triggering of the valve.

e) Install a new insert 2 with the diaphragm 3 bonded to it in the valve. The insert should be installed with the diaphragm end facing toward the striker. [p 437]

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f) Assemble the fragment filter and connect the tubing to the diaphragm valve and filter. Safety the coupling nuts with KO-KO.8 wire.

g) Remove the parts of the sheared rivet from the bushing and shaft of the forward delay lock. Close the lock, install the shaft in the lock after first coating with TsIATIM-201 grease, shift the cylinder piston rod and rivet it to the bushing with a 3520A-2-6 aluminum rivet.

h) With the ejection seat removed from the aircraft, install a check pin in the dump valve of the TSM-2500-38 firing mechanism and safety it with MIM-KO.5 wire. Operations at this point should be performed in the sequence indicated in Chap IX, in the Section, "Removal and Installation of the TSM-2500-38 Firing Mechanism.

i) Unload the canopy initiator and make certain that the primers of the blank cartridges have been indented by the firing pin.

j) Check the proper functioning of the initiator by listening for the "click" produced by the drive mechanism on the right side of the canopy.

Load the initiator with a live PV-1 cartridge and after checking the cycling of the emergency lock system, safety all the units (see Section 6).

WARNING: When performing ground maintenance in the cockpit of the aircraft, guard the cable leading to the catch on the emergency valve of the canopy jettison system against loading from outside forces since this could cause partial deflection of the detainer and subsequent self-triggering of the valve.

Make certain when closing the canopy that the canopy emergency jettison lever is in the forward and locked position. Closing the canopy with this lever deflected aft could result in damage to the lever and the triggering mechanism on the canopy. [p 43

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[p 439]

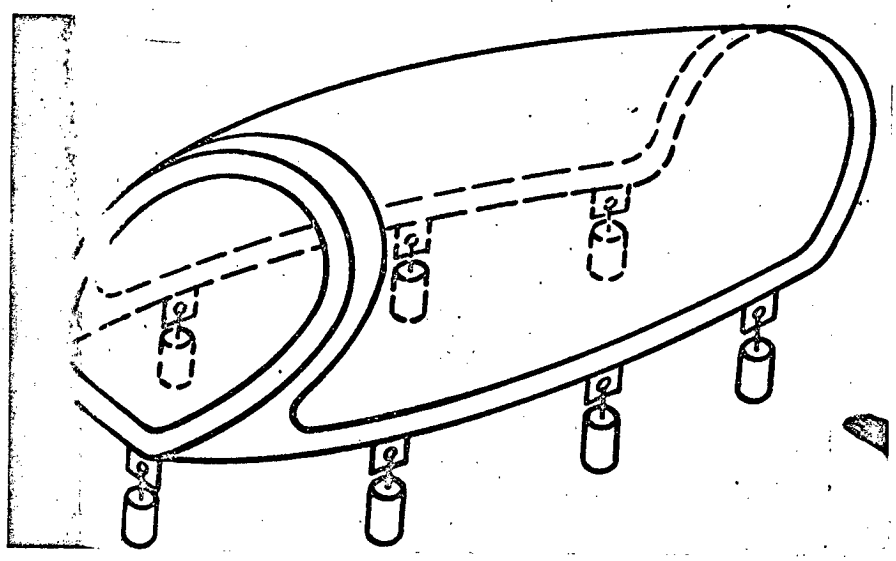


Fig. 99. Diagram showing how the weights are suspended when checking the operation of emergency locks.

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6. Checking the cycling of the emergency lock system.

1. Place the canopy on supports and suspend a 5-10 kg weight from the latches of each lock.

2. Unscrew the firing mechanism from the initiator and attach the device for testing lock cycling to the housing of the initiator. To this testing device connect an external compressed air tank through a reduction valve to supply 5-10 kg/cm^2 pressure.

3. Make certain that the emergency jettison system is in a locked position, open the valve of the air tank and feed air to the [testing] device through the reduction valve at a pressure of 5-10 kg/cm^2.

4. When this pressure is applied, the emergency lock opening system will cycle. The latches of the locks will drop from the canopy and the forward hinge-lock assemblies will open.

WARNING: 1. Make certain the latches of the locks are not damaged when they drop out.

2. Each latch has the number of the lock in which it must be reinstalled.

After this check, reset the locks in the following sequence: [p 440]

- Insert latch "1" (Fig. 100) in its lock (of the same number) and then turn lever "2" downward and release locking leaver "3" by turning it with a rod (a scriber or awl) inserted through the eye of the lever. This will correspond to a "lock closed" position.

- With the lock in the closed position, suspend a 3 kg weight from the eye of the lever or apply force with a spring-loaded 72-7804-820 clamp.

- After closing all six side locks, close the front hinge assemble by deflecting the upper end of the large clamp "4" (Fig. 95) rearward (i.e. decrease the gap formed by the large and small clamps) and throwing the

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[p 441]

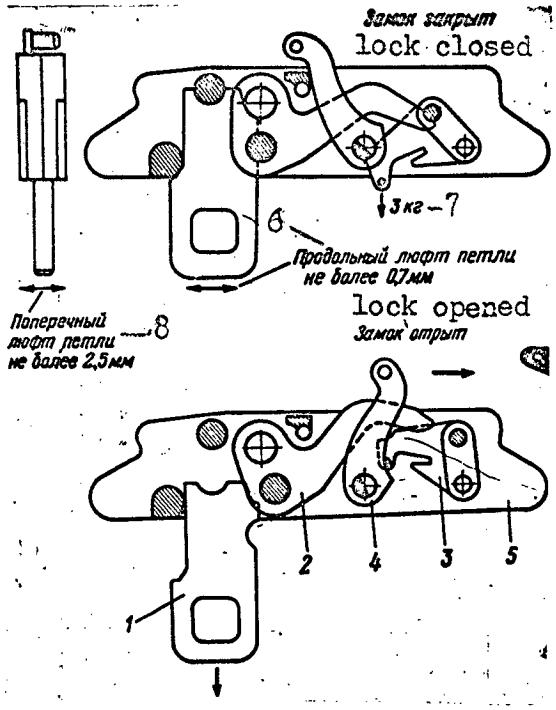


Fig. 100. Side emergency lock.

1 - Latch
2 - Lever
3 - Locking lever
4 - Rocking arm with stop rod
5 - Housing
6 - Longitudinal play of the latch should not exceed 0.7 mm
7 - 3 kg
8 - Lateral play of the latch should not exceed 2.5 mm

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stop lever 2 aft (Fig. 95).

Simultaneously turn the bellcranks 27 (Fig. 87) forward, checking to see that the crescent-shaped hooks of the cylinder piston rods enter the notches in bellcranks 24.

- By this movement the system of rocking arms and rods moves forward, holding the emergency lock mechanisms in the reset position.

NOTE: In resetting the system, the rear lock-clamp units should be open (Fig. 94), otherwise the system does not reset (does not lock).

- Make certain that the latches of the side locks do not drop out and that the front hinge-lock assembly does not turn.

No play is permissible in the clamps in the closed position gripping the canopy attach bolts.

- Safety and seal all units of the canopy jettison system in accordance with Fig. 91.

- Install the canopy on the aircraft (see Section 4).

- Check for correction installation of the canopy emergency jettison system in the full locked position according to the alignment of the openings in the left hook of the piston rod and the bellcrank (this is checked by probing with a ground safety pin).

- Load the initiator of the canopy emergency jettison system with a live NV-1 cartridge, install a ground safety pin in it, and safety the large nut and lever of the initiator (Fig. 91). /p 44

- Remove the ground safety pin from the initiator of the canopy emergency jettison system.

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NOTE: 1. Locking the system without first pulling down the locking levers "3" of the side locks (Fig. 100) with either a 3 kg weight or the 72-7804-820 device is prohibited. Failure to pull back these levers will result in crumpling of the contact surfaces on the locking levers "3" and the stop rod on the rocking arm "4" and the system will fall out of adjustment.

2. Locking of the system should be performed as indicated in point 4 above by movement of the double-arm levers [27] forward (Fig. 87).

It is permissible to lock the system by means of the bellcranks 24 which lock the hooks of the actuator cylinder piston rods. Locking the system by the levers on the rear locks is not permissible. [p 443]

3. A check is made of the cycling of the lock-catch system only in cases when the canopy or seat has been replaced, when disassembling the special panels, or when repairing the canopy (replacement of locks, glasswork, etc).

After checking and locking the emergency lock opening system, safety and seal it at the rear locks (Fig. 91, Position 4).

7. Preserving the Canopy

In a case when an aircraft is to be idle for more than 3 months, it is recommended that the canopy and its system be preserved.

Before the preserving operations, the following must be done:

1. Release the air from the aircraft utility system and the canopy emergency bottle.

2. Unload the canopy initiator cartridge.

3. Trigger the firing pin of the canopy initiator.

4. Disconnect the tubing from the diaphragm valve of the jettison system, remove the insert with its diaphragm and trigger the valve striker (pull the sear). Take the necessary precautions for protecting the inserts during the time the aircraft is in storage.

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Preserving Procedure

1. Coat exposed sections of the cable linkage on both the canopy and fuselage with TsIATIM-201-base graphite grease.

2. Cover the following with a thick coat of TsATIM-201 grease:

a) all connections of the canopy control and emergency jettison systems:

b) the emergency diaphragm valve;

c) the interior of the initiator;

d) the emergency locks located in the longitudinal sections of the canopy (block any access of mositure to the locks);

e) the exterior canopy control handle (on the fuselage);

These operations are performed without removing the canopy from the aircraft.

8. CARE OF THE CANOPY GLASSWORK

Components of the canopy glasswork which are made of organic glass require special attention and care.

Various types of damage to the surfaces of the organic glass such as scratches, nicks and crazes impair the optical properties and decrease the visibility whereas cracks, nicks, etc lower the mechanical strength of the glass.

To prevent damage to components of the canopy made of organic glass, they should not be subjected to long exposure to sunlight or dust and should be protected against the action of organic solvents or their vapors (such as acetone, benzene, alcohol, etc) which causes the formation of crazes on the surfaces.

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In the care of organic glasswork the following must be observed.

1. When the aircraft is parked, all glasswork must be covered with a jacket for protection against sunlight, dust, rain, snow and mechanical damage.

Before covering the canopy with the jacket, carefully clean it [the jacket] of sand and dust, particularly on the side which will come in contact with the canopy.

2. Prior to or after a flight, if the glasswork is dirty, carefully clean it in the following manner:

a) wipe the glass with a clean soft cloth thoroughly dampened with water;

b) if there are greasy stains on the glass, rub lightly with a dry soft cloth and a little VIAM-2 paste and then wipe as indicated immediately above.

If no VIAM-2 paste is available, wash the glass with a soft cloth soaked in soapy water (3-5% solution of a neutral soap).

c) Wipe the glass with a soft cloth thoroughly moistened with clean water and then rub dry with a soft dry cloth.

NOTE: Use of wool or silk cloth to wipe the glass is prohibited since it generates an electrical charge in the plexiglass, promoting attraction of dust to the surface.

3. The following flaws are permissible in components of the glass- [p 446]
work:

a) hairline scratches, but not in the form of a continuous network;

b) surface scratches and shallow nicks not longer than 30 mm, scattered over the surface.

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4. In the event hairline scratches are noted on the glass it is recommended that it be polished with VIAM-2 paste.

Polishing is performed by hand with absorbent cotton and a small amount of the paste first along the scratches, then across them, and finally with circular motions with light pressure but not too long in one spot to avoid heating the surface of the glass due to friction. It is permissible to polish the entire surface.

Removal of scratches and nicks with emery paper is not permitted, no matter where they are located.

Removal of crazes with emery paper, by scraping, grinding, polishing or localized heating is prohibited.

5. When performing maintenance on an aircraft the glasswork should be protected against mechanical damage by special jackets or covers.

9. Operation and Maintenance of the Anti-Icing System [p 447]

The anti-icing system (Fig. 101) makes it possible to remove ice from the windshield of the canopy during flight. Ice removal is accomplished by bathing the windshield with ethyl alcohol.

The anti-icing system is activated by depressing the button "12" marked "Windshield Anti-Icer" on the left side of the instrument panel. The automatic circuit breaker AZS 11 (Fig. 101) should be switched in beforehand. Upon depressing button "12" the electric circuit of the 695000/M valve is closed and compressed air is fed through the RV-3 reduction valve and into the 5-liter alcohol tank "1" of the anti-icing system.

The alcohol is forced out of the tank and through the check valve 5 by the air pressure and into the manifold 4 on the canopy. The system is turned off by releasing the button.

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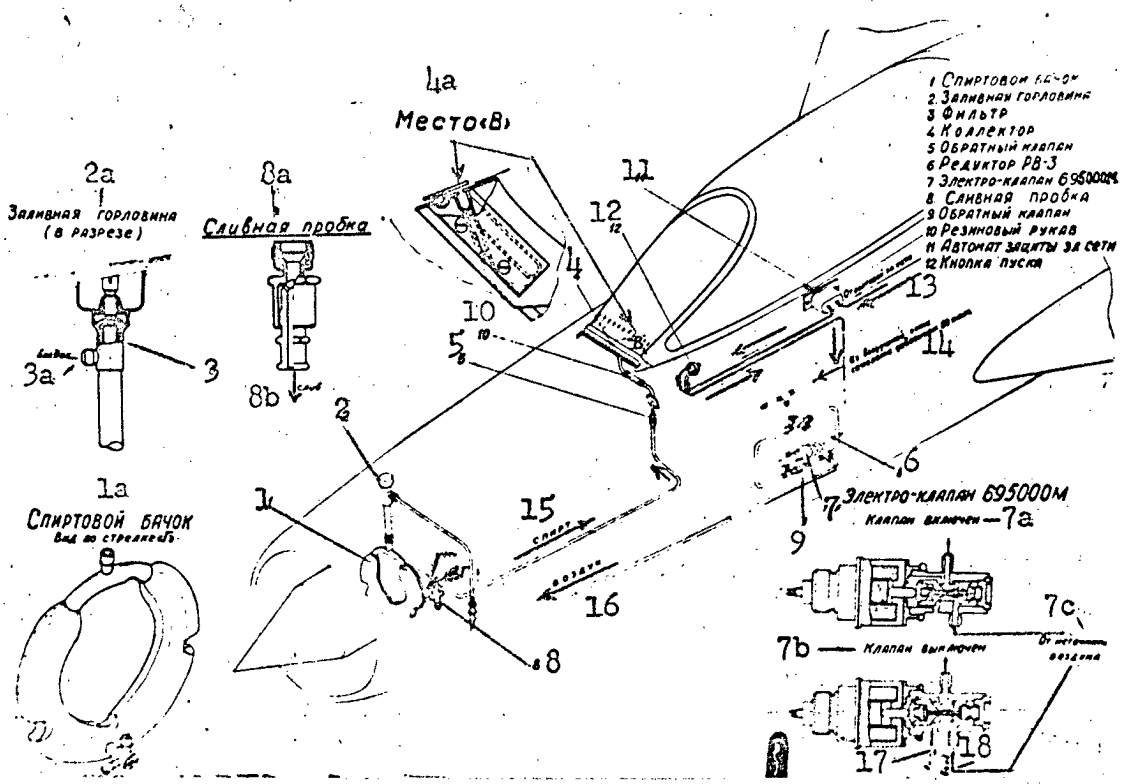


Fig. 101. The canopy de-icer.

1 - Alcohol tank
1a - Alcohol tank (view along arrow)
2 - Filler neck
2a - Filler neck (cross section)
3 - Filter
4 - Manifold
4a - Location B
5 - Check valve
6 - RV-3 pressure reducing valve
7 - 695000M electric valve
7a - Valve on [open]
7b - Valve off [closed]
7c - From the air supply
8 - Drain plug
8a - Drain plug
8b - Drain
9 - Check valve
10 - Rubber sleeve
11 - Circuit breaker
12 - De-icer button
13 - From the aircraft electrical circuit
14 - From the aircraft air utility system
15 - Alcohol
16 - Air
17 - [illegible]
18 - In

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For the most effective use of the alcohol, the system should be kept switched on for 2-3 sec.

If one switching is not sufficient for removing the ice, subsequent ones of longer duration are necessary.

With this system it is possible to make 20-30 switchings of 2-3 sec duration.

To check the working order of the anti-icing system, switch it on for a period of no longer than 1-2 sec. In this case fluid should flow [p 4] from all the openings in the manifold.

If this is not so, the exit openings in the manifold should be cleaned with a 0.4 mm diameter copper wire (the diameter of the openings is 0.5 mm). In order to do this the manifold must be removed from the canopy, and the deflecting plate from the manifold.

On the dates specified in the maintenance check list, remove the anti-icer tank from the aircraft, flush it with water, and then check the system for leaks and the rate of discharge of fluid from the manifold.

The system is checked for leaks using air at a pressure of 3 kg/cm^2.

To make this check, disconnect the manifold and check valve from the system and cap the open end of the tubing. Depress the button and charge the system with air.

Leakage of air at tubing connections is not permissible. After checking the system for leaks, reconnect the manifold and check valve.

Checking the rate of discharge of fluid from the manifold is

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performed with the tank completely filled. Depress the button and measure the time required for all the fluid to flow from the manifold. The system is considered as being in good working order if this time is 2 min.

When checking the discharge rate of the anti-icing system the tank should be filled with not less than 5 liters of water.

After this check, flush the water from the tank and system with alcohol (1 liter).

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CHAPTER IX

The Ejection Seat

1. General Information

The SK type seat (See figures 102, 103, and 104) installed in the aircraft has the following principal design features:

The cockpit canopy is used to protect the pilot from the airflow during ejection and makes it possible to raise abandon-aircraft speed to 1,100 km per hr.

The parachute harness is used to secure the pilot to the seat.

The use of automatic cinching during ejection makes it unnecessary for the pilot to be in a specific position.

Instead of footrests, there are leg supports with clamps which automatically secure the legs during ejection.

A parachute is installed on the telescoping tube which stabilizes the movement of the seat in the airflow after ejection from the aircraft.

Continuous adjustment of the seat height on the ground or in the air makes it convenient for the pilot to operate.

The minimum safe altitude of ejection in horizontal flight was reduced to 110 meters by shortening the time required to complete preparations for ejection. [p 455]

A heavier ejection unit (because of the canopy and track mounted on the seat) reduces stresses acting on the pilot at the initial moment of ejection and after emergence of the seat in the airflow.

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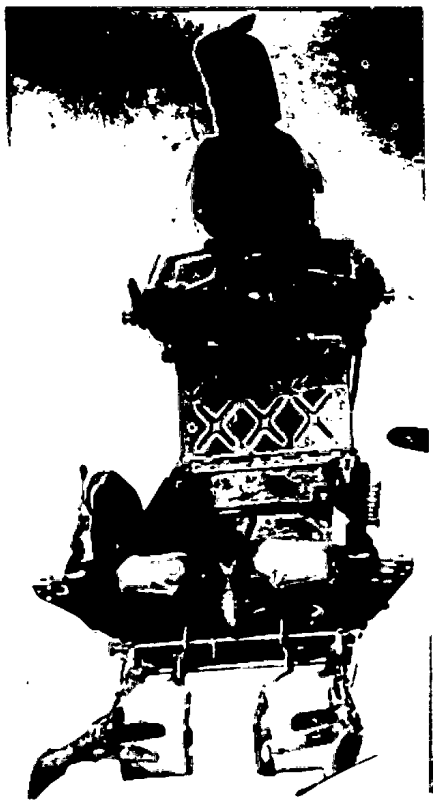


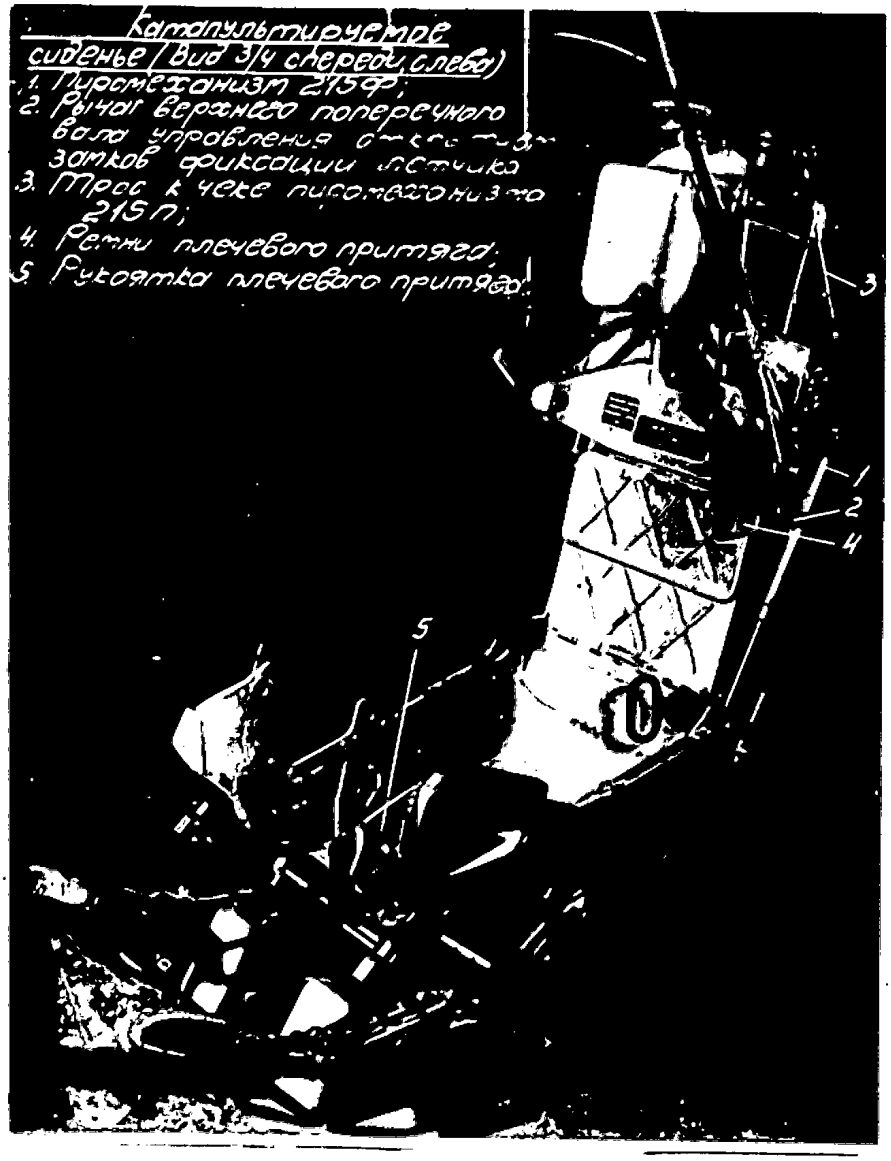
Fig. 102. The ejection seat.

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Fig. 103. The ejection seat -- 45° left front view.

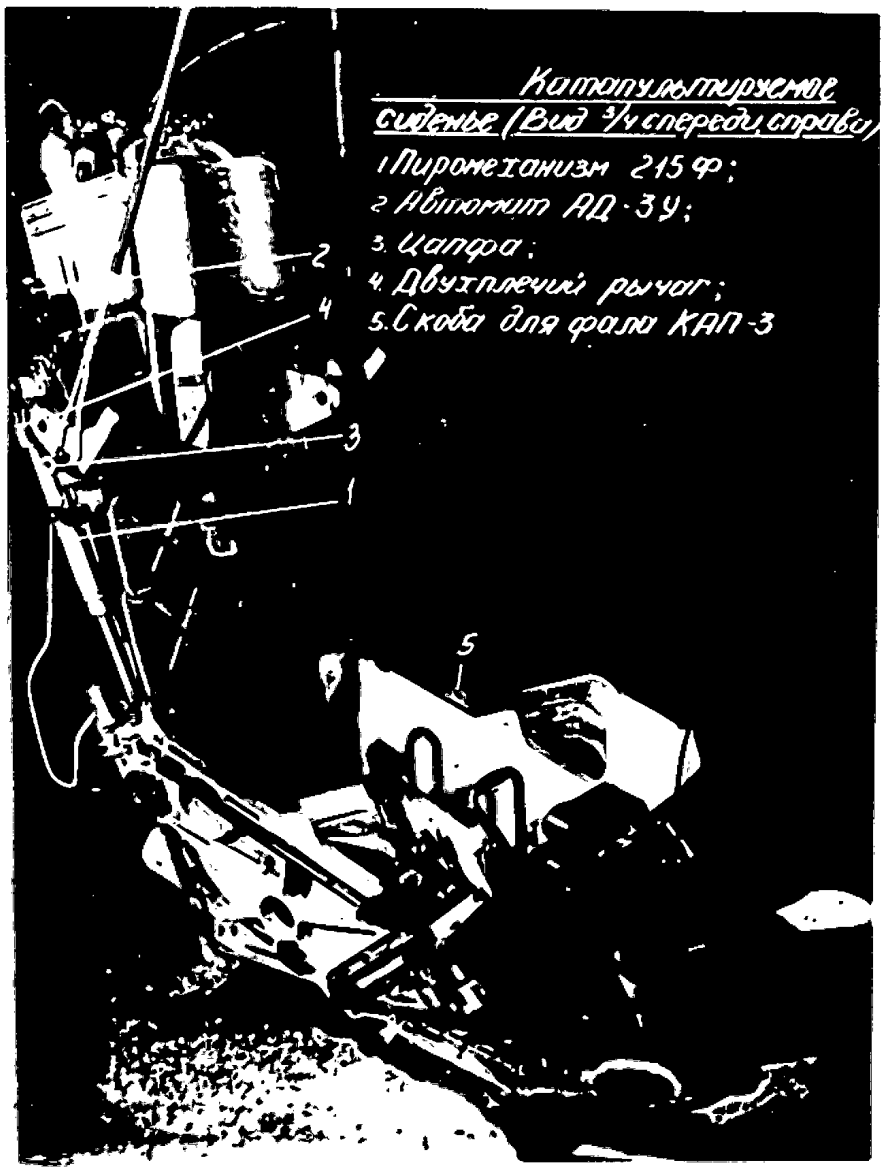
1. 215F initiator
2. Actuating arm of the upper transverse shaft controlling the pilot's belt locks
3. Cable to the 215F initiator pin
4. Shoulder harness straps
5. Shoulder harness lever

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Fig. 104. The ejection seat (45° right front view).

1. 215F initiator
2. AD-3U automatic device
3. Pin
4. Bellcrank
5. KAP-3 lanyard attachment

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All of this makes a safe ejection at high speeds possible. The ejection system is described in figure 105.

The following systems and devices incorporated in the construction of the SK type seat provide the above-mentioned features.

1. The pilot's parachute harness is integrated with the seat (See figure 106), i.e., it is used to secure the pilot to the seat by the means of the shoulder harness to cinch the shoulders and the lap belt to cinch the lap.

This type of combination parachute harness allows the pilot to put on and take off the parachute in the cockpit while the parachute remains in the seat of the chair.

The shoulder harness is cinched by means of a spring loaded telescoping cylinder controlled by the pilot through a handle located on the left armrest of the seat (See figure 107).

In event of ejection, powder gases from the 215R initiator are ducted to the telescoping cylinder which is used to secure the shoulders. Levers on the seat armrests used to fire the seat ejection system [p 458] are also used to fire the 215R initiator.

The shoulder harness restricts the pilot's range of movement from the extreme forward to enable him to operate cockpit controls to the extreme aft for takeoff, landing, and ejection.

The lap belt is secured by the pilot after he is seated in the cockpit and puts on the parachute harness.

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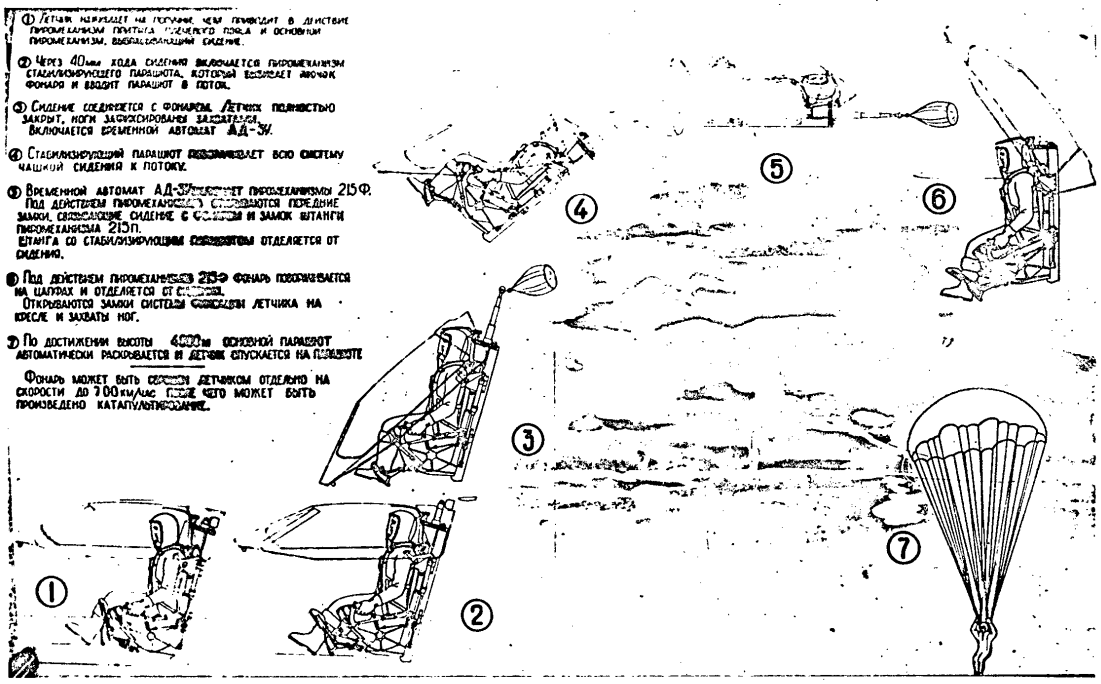


Fig. 105. Ejection diagram.

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Fig. 105. Ejection diagram. [p 456]

1. The pilot presses on the handgrips which activate the shoulder harness cinch initiator and the main seat ejection initiator.
2. After the seat travels 40 mm, the stabilizer parachute initiator is activated which knocks out the canopy access hatch and releases the parachute into the airflow.
3. The seat and canopy connect. The pilot is completely covered and his legs are secured with clamps. The AD-3U automatic time-delay is activated.
4. The stabilizer parachute turns the entire system so that the bucket seat faces the airflow.
5. The AD-3U time delay activated the 215F initiator. Initator action opens the lock of the 215P initiator tube and the forward locks connecting the seat with the canopy. The tube with the stabilizer parachute separates from the seat.
6. The action of the 215F initiator rotates the canopy on pins, and the canopy separates from the seat. The locks holding the pilot to the seat and the leg clamps unlock.
7. At 4,000 meters, the main parachute automatically opens, and the pilot descends by parachute.

The pilot may jettison the canopy separately at speeds up to 700 km per hr and then eject.

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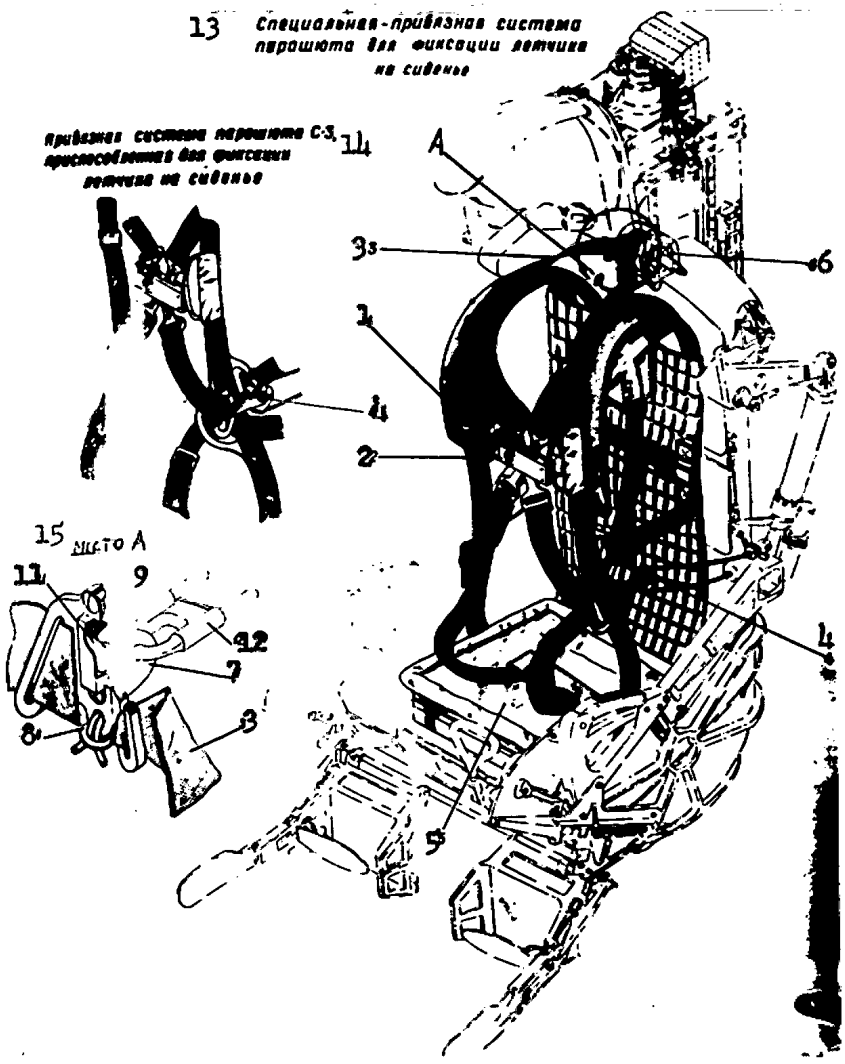


Fig. 106. System securing the pilot.

1. Shoulder harness lock
2. Central secure system lock
3. Shoulder harness
4. Lap belt cinching assembly
5. S-3 parachute
6. Shoulder harness lock
7. Shackle
8. Elastic cord
9. Shackle lock
10. [illegible, blacked out]
11. Spring
12. Shoulder harness lock
13. Special parachute harness for securing the pilot to the seat
14. S-3 parachute harness adapted for securing the pilot to the seat
15. Location A

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The lap belt is adjusted with the lever and ratchet gear provided on the right armrest of the seat. To tighten the belt, swing the lever back and forth (See figure 107, letter A).

To loosen the belt, move the lever forward as far as it will go, hold it there, and move the lower part of the housing forward.

2. An ORK-2 disconnect mounted on the left armrest of the seat connects the pilot's personal leads to the aircraft system, disconnects them during ejection, and switches over the pilot's oxygen supply to the parachute system. When the seat moves upward, a cable connecting the disconnect to the fuselage automatically separates the upper and lower blocks of the ORK-2 disconnect.

3. In the air or on the ground, the seat is adjusted for pilot [p 461] height with the aid of a MU-100AP motor and limit switches. A push-button switch on the left side of the cockpit turns on the electric motor.

The seat is adjusted by moving the seat bucket (maximum of 90 mm) with respect to the seat track on which the MU-100AP electric motor, reducer, and a jack screw are mounted; the screw collar and guides which slide along the track are mounted on the seat bucket.

Limit switches installed on the seat track and connected to the bucket by a connecting rod are used to turn off the electric motor at the extreme positions of the bucket.

When the bucket is in the extreme upward position, there should be

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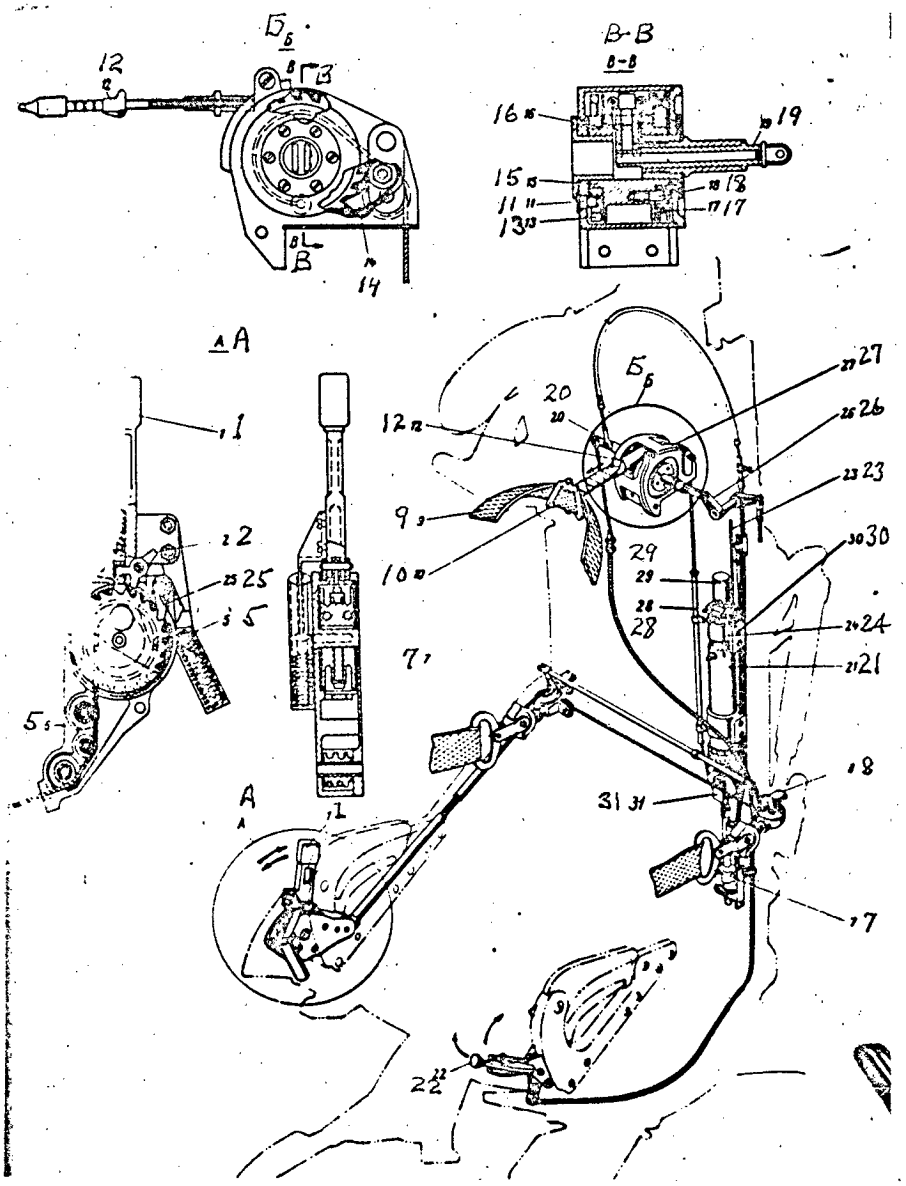


Fig. 107. Operational cinch mechanisms of the fastening system.

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Fig. 107. Operational cinch mechanisms of the fastening system. [p 460]

1. Lap belt handle
2. Dog
3. Catch
4. Ratchet wheel
5. Handle return spring
6. Cinch handle
7. Shackle and buckle
8. Lap belt lock
9. Shoulder harness strap
10. Buckle
11. Screw
12. Lock strap
13. Ratchet segment
14. Locking dog
15. Lock cylinder
16. Strap lock locking lever
17. Cable roller
18. Shoulder harness lock catch
19. Locking pin
20. Actuating arm of the operational cinch mechanism
21. Locking pin
22. Operational cinch handle
23. Connecting rod to the TSM-2500-38 initiator
24. Seat firing control handle connecting rod
25. Dog
26. Emergency shoulder harness lock opening mechanism
27. Shoulder harness lock
28. Cable tube
29. Actuator
30. Top coupling
31. Lower cap

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a space between the pilot's pressurized helmet and the canopy glass. Therefore, to compensate for pilot height, the extreme upward position of the bucket must be regulated by adjusting the upper coupler of the rod connected to the limit switches. In this case, over-all seat adjustment (for a large height) will be reduced.

To facilitate vertical seat adjustment when the same aircraft is flown by pilots of different heights, the limit switches mechanism is provided with four movable pointers which are set according to the height of each pilot.

To supply power from aircraft sources to the MU-100AP electric [p 462] motor, an electrical plug-and-socket connector is mounted on a bracket. The plug is connected with a lanyard through a snap lock to a clamp on the fuselage. This disconnects the plug-and-socket connection during ejection.

4. At ejection, the seat catapult system (See figure 108), i.e., the TSM-2500-38 initiator, is activated by levers on the right and left armrests connected by rods and cable to the TSM-2500-38 initiator pin.

To set off the seat catapult system, it is necessary to press the top and lower levers on one of the seat armrests, which will unlock the lever locks.

The seat catapult system may be activated either with the lever on either armrest or with levers on both armrests.

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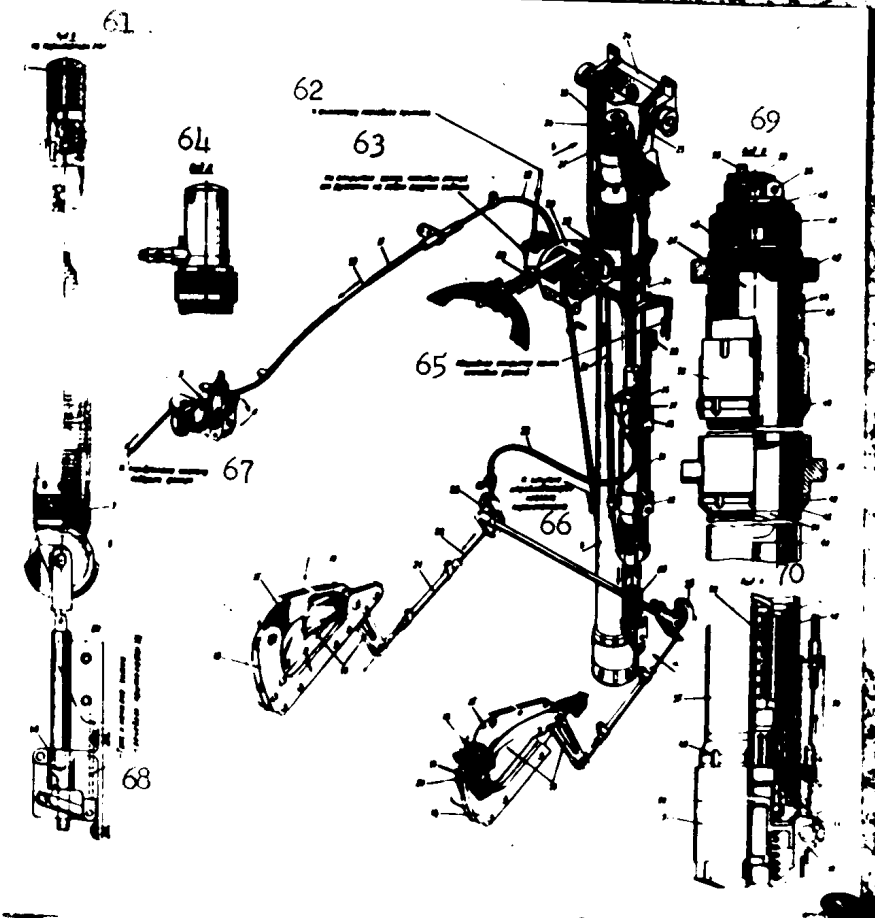


Fig. 108 Seat Firing Control and Forced Cinching of the Shoulder Harness

Фиг. 108. Управление контролем высоты и принудительная пристяжка плечевых ремней.

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Fig. 108. Control of seat ejection and of the preliminary fastening of the shoulder harness [p 464]

1. 215R initiator for securing the pilot
2. Initiator breech mechanism
3. Inner cylinder
4. PK-3M-1 cartridge
5. Outer cylinder
6. Stop
7. Nipple
8. Roller
9. Cantilever
10. Cable
11. Tube
12. Bowden cable casing
13. Right armrest
14. Left armrest
15. Seat ejection control handle
16. Rocker arm
17. Spring
18. Spring
19. Spring
20. Dog
21. Tube
22 Cable
23. Segment gear
24. Initiator mounting bracket
25. Braces
26. TSM-2500-38 initiator pin
27. Cable
28. Lower initiator coupling
29. Shoulder harness lock strap
30. Shoulder harness lock
31. Cable
32. Bowden cable casing
33. Bracket
34. Connecting rod
35. TSM-2500-38 initiator telescoping tube
36. Rocker arm
37. Shackle
38. 215R initiator fastener coupling
39. Striker and roller
40. Firing spring
41. Breech housing
42. Captive nut
43. Upper initiator coupling
44. Casing
45. Middle cylinder I
46. Outer cylinder
47. Middle cylinder P
48. Inner cylinder
49. Lock nut
50. Blade
51. TSM-2500-38 initiator lock
52. Piston
53. Grate bar
54. Bracket
55. TSM-2500-38 initiator pin
56. Cartridge indicator
57. PK7-UM cartridge
58. Lug bolt
59. Rocker arm
60. Support
61. 215R initiator view C
62. To the shoulder harness
63. For opening the shoulder harness lock through the handle on the left armrest
64. View A
65. Shoulder harness emergency opening strap
66. To the jettisoning actuator
67. To the canopy jettisoning system
68. Cable to shoulder harness lock
69. View B
70. View D

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As the seat catapult system levers are first pressed, the 215R shoulder harness initiator is fired which secures the pilot in the rear-most position, then as the levers are pressed still further, the TSM-2500-38 seat catapult initiator is activated.

In the initial position, the firing levers are held by springs and are secured with special locks on the levers.

5. A stabilizer parachute for stabilizing the seat in the air- [p 465] flow during ejection is installed in a container behind the headrest. (See figure 109). The 215P initiator is used to place the parachute in the airflow, and, at the same time, to knock out the hatch cover in the canopy. The extending telescoping initiator tube with parachute attached carries the parachute into the airflow, the parachute creates a counterforce to the force of the TSM-2500-38 initiator, and turns the seat on its back.

As the seat travels 30-50 mm upward during ejection, the 215P initiator is fired when the lanyard attached to the fuselage pulls out the initiator pin. The pin is connected to the lanyard with a marine pin which facilitates dismantling the seat. The marine pin is connected with a lanyard to the frame of the seat to prevent loss.

A clamp is fastened to the yoke on the initiator telescoping tube and holds the parachute container with two pins ending with cables and balls.

The pins are safetywired with KOK-0.5 wire and sealed. The cables with

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[p 466]

Fig. 109. Seat headrest.

1. Parachute with container
2. Swivel
3. Parachute shroud lines
4. 215P initiator
5. AD-3U automatic device
6. Spring mechanism

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the balls are inserted into tubes which are attached to the seat. The ends of the tubes are made to just fit the diameter of the cables, so that after the initiator telescoping tube travels about 250 mm, the balls are stopped in the tubes jerking out the pins from the apertures in the side section and in the container, thus freeing the parachute to open.

A swivel is fastened to the top of the 215P initiator telescoping tube. An eye ring is fastened to the swivel and the parachute shroud lines are fastened to the eye ring. The shroud lines coming from the parachute container are placed in a cover, which, in turn, is placed in a recess to the right and behind the headrest and fastened with a snap lock.

6. To prevent the legs from spreading during ejection and to [p 468] secure them in a fixed position, leg supports and brackets with an opening mechanism are provided on the seat (See figures 110 and 111).

Each leg support has a pin on the inside which is inserted into the guide track fastened to the floor of the cockpit. When the seat is adjusted for height, the support pins move in the guide track without leaving it.

During ejection, the support pins leave the track, and the supports turn as the seat is ejected from the cockpit. Inertia forces the pilot's legs against the supports where they press against the leg clamp activating levers. As the leg clamps turn, they are locked with segment gears, and the legs are secured between the clamps and rubber cushions of the supports.

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[p 469]

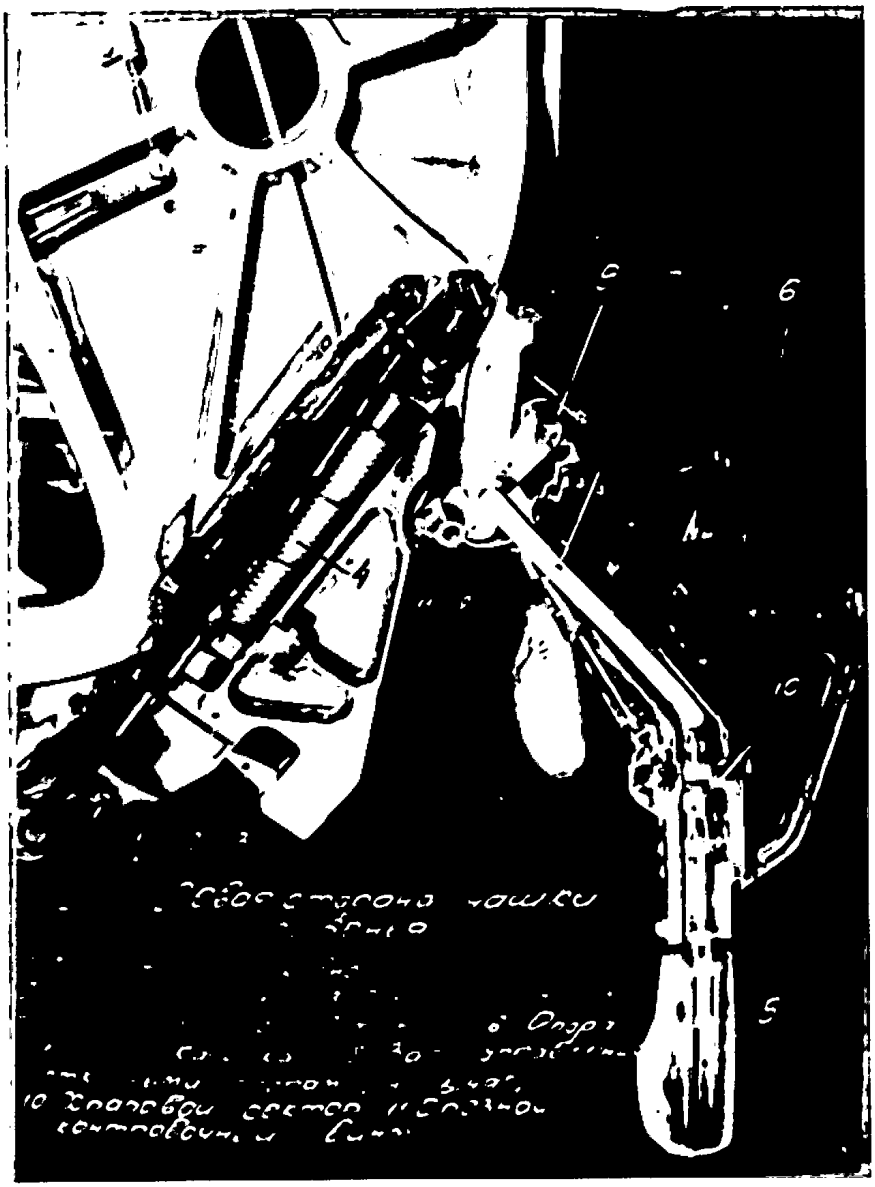
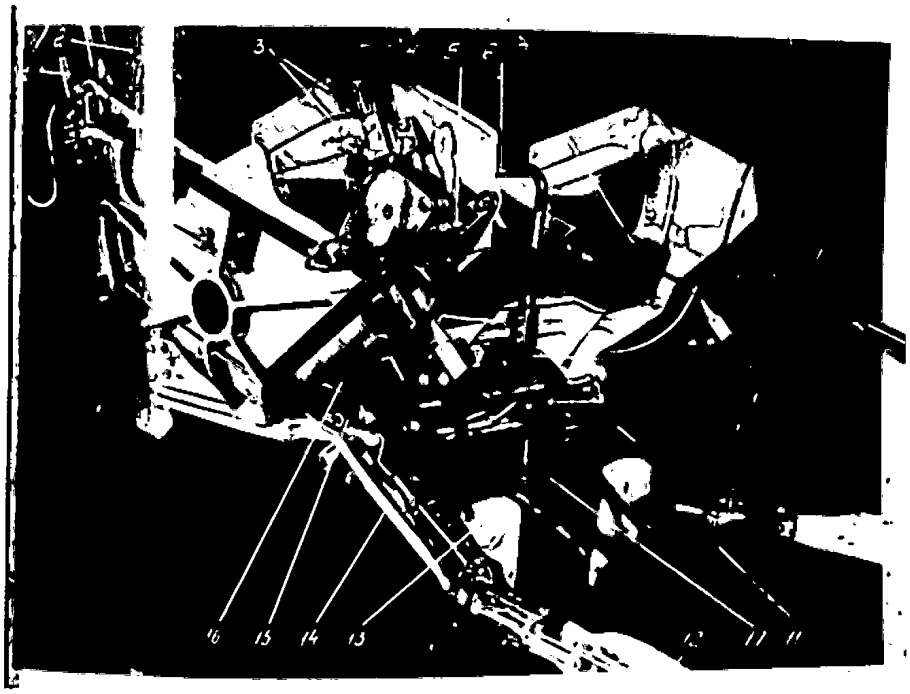


Fig. 110. Left side of seat bucket.

1. Hinged support bracket
2. Hinged support
3. Pin stop
4. Spring
5. Leg clamp
6. Leg supports
7. Rocker arm
8. Hinged support control shaft
9. Actuating arm
10. Gear segment
11. Safety-lock shear screw

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[p 471]

Fig. 111. Right side of the seat bucket.

[p 472]

1. 215F initiator breech mechanism
2. Lap belt roller and buckle
3. Firing lever
4. Lap belt handle
5. Hinged support bracket
6. Canopy emergency release lever
7. Leg pads
8. Transmission roller
9. Leg support fastening lever for the ground safety pin
10. Segment gear
11. Clamp closing lever
12. Clamps
13. Leg supports
14. Rocker arm
15. Hinged support control shaft
16. Hinged supports
17. Pin connecting the cable of the hinged support control shaft

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7. To make it possible to eject with the protection of the canopy, supports are provided to fasten the canopy to the seat as follows:

a) Under the rear canopy catches, at the ends of the transverse truss of the seat frame, there are trunnions which when the seat moves about 20 mm upward enter the canopy rear lock catches and are secured (See figure 104, caption 3).

At the same time, the rods connecting the locks and rockers trigger the canopy emergency unlocking system which opens the locks fastening the canopy to the fuselage. However, as the forward edge of the canopy begins to move, a delay hook holds it.

As the seat moves further upward, the canopy moving with it [p 473] turns on the trunnions and begins to cover the pilot, and the rollers at the front section of the canopy roll over the transparent armor glass.

b) Hinged supports are mounted along the sides of the seat bucket for the front canopy catches. The supports are always in the folded position and are fastened with segment gear mounted on the main shaft (See figures 110 and 111).

The shaft is fastened with a shear screw screwed into the left segment gear and into the support (See figure 125, caption 11).

As the seat moves upward about 520-540 mm, the supports reach the panel under the canopy, the cable fastened to the cockpit floor and to the

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rocker on the shaft turns the shaft with the segment gear shears the screw, and releases the hinged supports (See figure 112).

The spring loaded hinged supports are forced out and are kept in position by special holding springs. The canopy, falling on the supports, hits the lock pins with its front catches, shears the safety screws in them, and latches itself to the supports with spring pins.

In this manner, the canopy is fastened to the seat at four points.

8. Two 215F initiators are mounted on the seat to jettison the stabilizer parachute and rod, to separate the canopy from the seat after ejection, and to unlock the leg clamps, shoulder harness, and lap belt of the pilot. Initiator rods are connected to the seat track bracket below; on top, the initiator cylinders are connected to a bell crank mounted on the seat trunnions. [p 475]

The initiator breech has two percussion caps, so that if one cap fails, the initiator will still fire.

After a delay of 1.5 seconds, the AD-3U mechanism automatically activates the 215F initiator. The lanyard triggering the mechanism should have about 50 mm of slack, as it is at this distance of travel of the seat from the fuselage that the AD-3U automatic is triggered.

In the event of AD-3U failure during ejection (the canopy will not separate from the seat) and also in event of emergency abandonment of the aircraft on the ground (to separate the pilot from the seat in this case, the canopy must be previously jettisoned or raised), the initiator

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[p 474]

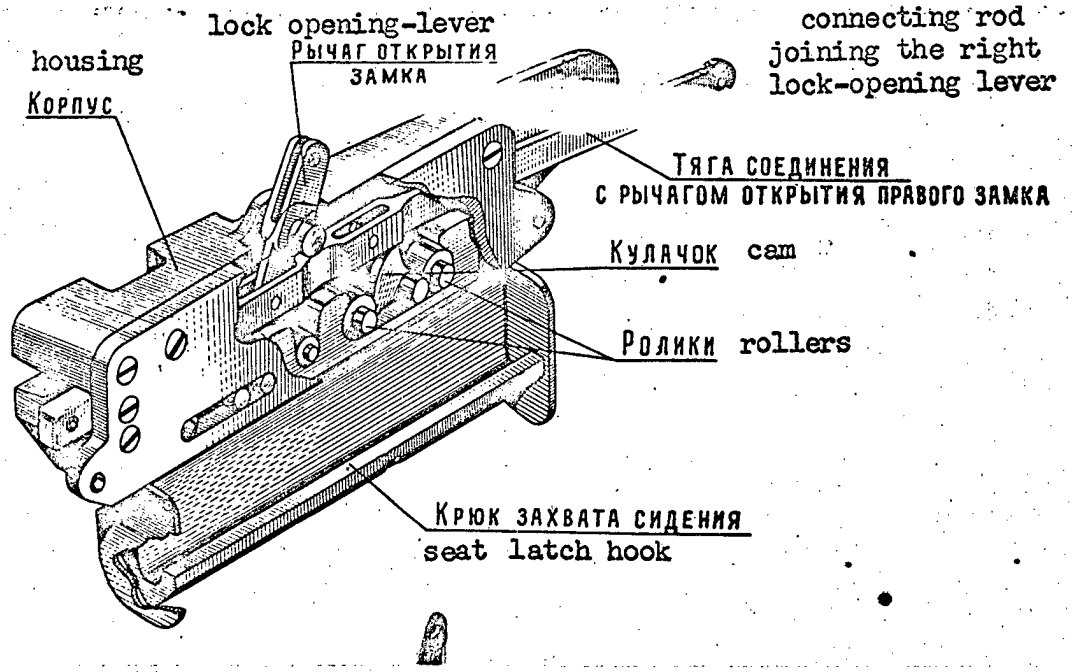


Fig. 112. Forward seat latch lock (left)

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can be triggered manually with the emergency system lever located on the seat bucket. In this event, the lever remains in the pilot's hands.

In the above-mentioned cases, the system operates as follows:

AD-3U Triggered:

1. As the seat travels upward 50 mm, the AD-3U lanyard, which is fastened to the fuselage, pulls out the pin, and after a delay of 1.5 seconds, the spring of the automatic device pulls the cable and turns intermediate lever 13 of the transverse shaft 10 lock (See figure 121).

The intermediate lever (having a travel of 8 mm) releases the lock, [p 476] and the lever controlling the 215F initiator turns the shaft and through a connecting rod triggers the initiator (See figure 121).

2. Under the force of powder gases, the initiator cylinders turn the bell crank about the seat trunnions.

At the same time the following occurs:

a) The system controlling the canopy front latch locks is activated and the canopy is released.

b) The system controlling the locks of the detachable yoke holding the 215P initiator rods is activated through connecting rods and rockers. The yoke opens and the rod together with the parachute separates from the seat.

Note: If the seat bucket is in the down position, the front latch locks will open before the stabilizer parachute rod is separated. If If the bucket is in the up position, the front latch locks will open after the stabilizer parachute rod is separated.

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c) As the 215F initiator fires, the bell crank will rotate, and the canopy will turn on the seat trunnions. As the canopy rotates about 110° on the trunnions, trunnion cams will release the aft canopy latches, and the canopy will separate from the seat.

d) At the end of the travel of the 215F initiator, the bell cranks will press on the upper transverse shaft levers and through a system of connecting rods and rocker arms will open the leg clamp, shoulder harness, and lap belt locks, thus freeing the pilot from the seat. The lap belt locks will open last so that the seat will separate properly from the pilot (See figure 113).

Manually Triggered: [p 478]

When the emergency handle is pulled 65-70 mm (the handle will be left in the pilot's hands), the roller will turn and will trip the spring actuator mechanism, and the 215F initiator will fire. At the same time, the mechanism for separating the canopy from the seat and the seat from the pilot will operate as was described above.

9. To reduce the force required to open with the emergency lever the locks securing the pilot, a spring mechanism (See figure 114, caption 4) is installed on the right side of the transverse shaft.

The spring mechanism is actuated after the 215F initiator is fired or through the action of the actuator when the emergency lever is pulled. The spring mechanism holds all locks securing the pilot in the open position.

10. When the pilot separates from the seat during ejection, the

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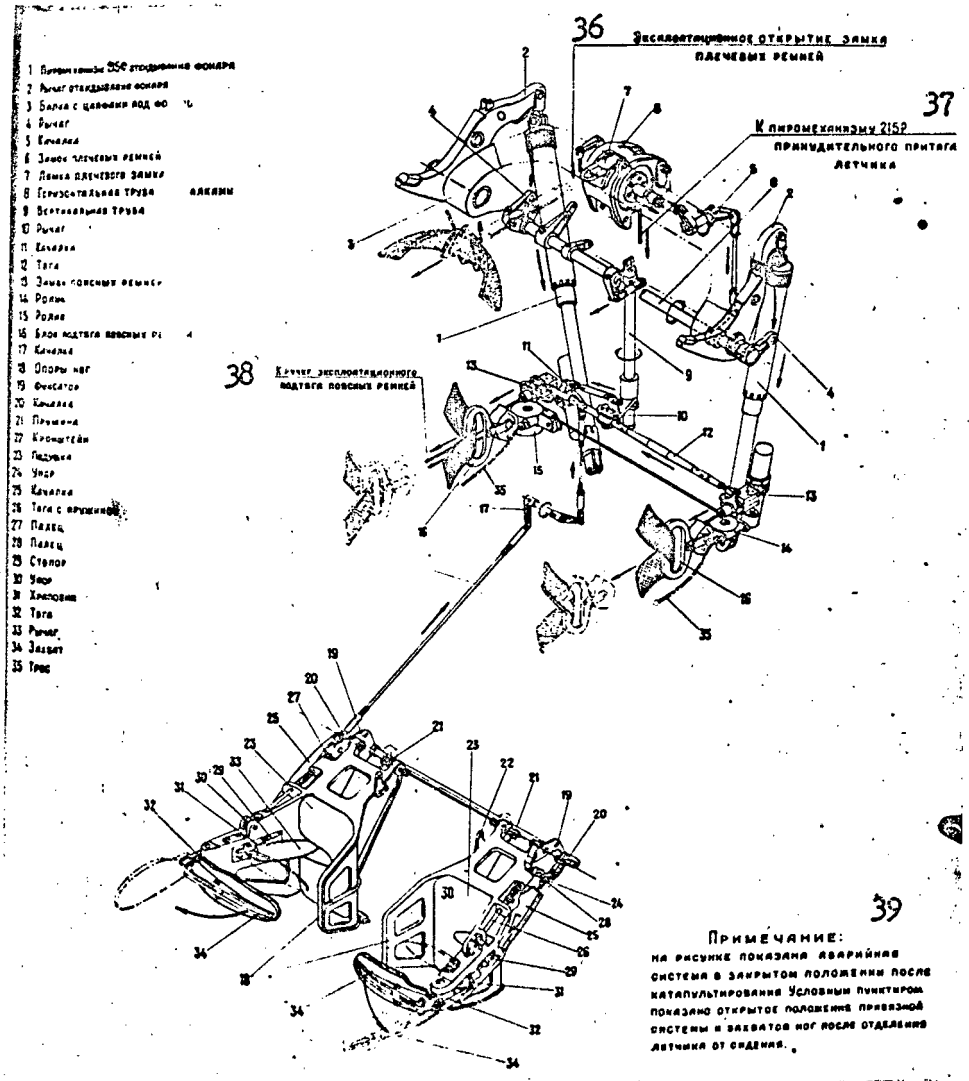


Fig. 113. Emergency opening of leg clamp locks.

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Fig. 113. Emergency opening of leg clamp locks. [p 477]

1. 215F canopy initiator
2. Canopy throw-off lever
3. Beam with trunnion under canopy
4. Actuating lever
5. Rocker arm
6. Shoulder harness lock
7. Shoulder lock strap
8. Horizontal tube with actuating arms
9. Vertical tube
10. Actuating lever
11. Rocker arm
12. Connecting rod
13. Lap belt lock
14. Roller
15. Roller
16. Lap belt cinch assembly
17. Rocker arm
18. Leg supports
19. Fastener
20. Rocker arm
21. Spring
22. Bracket
23. Pad
24. Catch
25. Rocker arm
26. Connecting rod with spring
27. Pin
28. Pin
29. Stop
30. Support
31. Segment gear
32. Connecting rod
33. Lever
34. Latch
35. Cable
36. Operational opening of the shoulder harness lock
37. To the 215R initiator for forced cinching of the pilot
38. To the operational lap belt cinch handle
39. Note: The emergency system as shown in the figure is in the closed position after ejection. The open position of the fastening system and of the leg clamps after the pilot separates from the seat is shown by dotted lines.

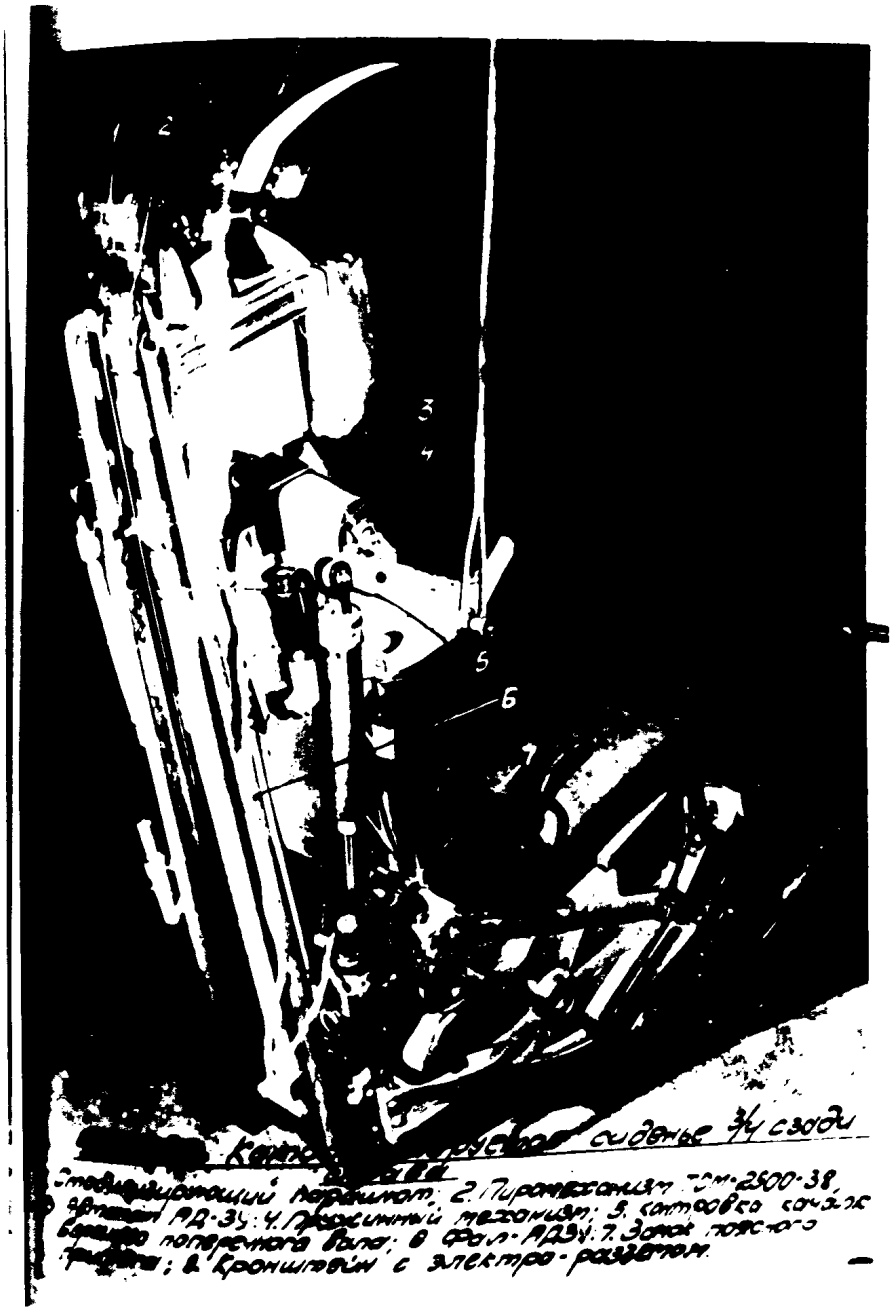
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1. Stabilizer parachute
2. TSM-2500-38 initiator
3. AD-3U automatic time delay device
4. Spring mechanism
5. Upper transverse beam rocker arm
6. AD-3U lanyard
7. Lap belt lock
8. Electrical connection bracket

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lanyard of the KAP-3 parachute assembly, connected with a snap lock to the seat clamp, pulls the pin in the KAP-3 which automatically opens the parachute.

11. To relieve stresses acting on the pilot when ejecting with a previously jettisoned canopy, a valve is provided in the lower part of the RSM-2500-38 initiator to deflect powder gases.

The valve control cable is connected to the canopy jettison emergency lever, and, consequently, when there is an emergency jettisoning of the canopy, the valve opens and deflects the powder gases.

12. The seat is connected to the fuselage at the following [p 481] operating-release connections:

a) Behind the upper pins of the RSM-2500-38 initiator, fastened to the seat headrest, there are special hooks which absorb vertical forces. The TSM-2500-38 initiator, in turn, is fastened to the fuselage with two connecting rods secured to the armor plate. The rods are attached to the initiator trunnions on the middle section of the outer tube.

To prevent the initiator from turning through more than 15° during ejection, the initiator is also fastend to two rocker arms one end of which has an oval slot and is secured to the initiator with bolts and the other end of which is attached to the roller shaft on the armor plate.

b) Two pairs of rollers fastened on brackets to the armor plate are inserted into the track. The rollers absorb forces acting on the

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seat in a direction parallel to the horizontal axis of the aircraft.

c) Track guides located on the floor of the cockpit distribute some of the force acting on the rollers and prevent the lower section of the seat from vibrating.

d) The electric power supply connection to the MU-100AP motor disconnects during ejection.

e) Connections which trigger mechanisms during ejection are as follows: [p 482]

Leg support pins in the guides on the floor of the cockpit secure the supports in a fixed position and release them during ejection.

The shaft rocker arm cable controlling the hinged supports under the canopy catches and the guide tube fastened to the cockpit floor releases the supports during ejection.

The cable connected to the ORK-2 and the clamp on the fuselage disconnects the ORK-2 and switches over the pilot's oxygen feed to the KP-27M parachute apparatus.

The cable attached to the 215P initiator pin and the back partition of the cockpit triggers the stabilizer parachute initiator.

The AD-3U lanyard fastened to the fuselage triggers the 215F initiator.

13. After the seat is manufactured at a plant, control systems triggering mechanisms during ejection are safety-wired and sealed. It is forbidden to tear off the metal seals before performing regulation maintenance.

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14. To prevent accidental triggering of seat initiators on the ground, the aircraft is equipped with two types of ground safety devices to each of which caprone cords are tied. The two types of safety devices are:

The so called "operational lanyard" with ground safeties intended [p 483] for the daily use of the aircraft. The safety devices are positioned in the aircraft immediately after a flight and are removed before take-off. Safety devices fastened to caprone cords on the "operational lanyard" are as follows:

a) One safety pin with the number 1 is inserted into the TSM-2500-38 initiator.

b) One safety pin with the number 4 is placed into the 215P stabilizer parachute initiator.

c) Two safety covers with the number 9 are installed on the seat armrests.

d) Two safety pins with the number 7 are put into the trigger levers on the seat armrests through openings in the safety covers.

e) One safety pin with the number 8 is put on the canopy emergency jettison lever.

f) One safety pin with the number 10 is put into the roller of the mechanism triggering the 215F initiator from the emergency lever.

[The other type of safety device is:] the so called "installation lanyard" which has ground safety devices intended for use when the seat is removed. It is placed in position before the seat is removed and is taken

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off after the seat is installed in the aircraft.

The following safety devices are attached to caprone cords on this lanyard: [p 484]

a) Two safety pins with the number 2 are inserted into the 215R initiator head and lever.

b) Two safety pins with the number 3 are placed into the 215F initiator.

c) One safety pin with the number 4 is put into the 215P initiator.

d) Two safety pins with the number 5 are inserted into the hinged supports of the front canopy latches.

e) Two safety pins with the number 6 are placed in the leg clamps to keep the clamps folded when the seat is being installed in the aircraft.

f) One flexible pin is inserted in the TSM-2500-38 initiator when the initiator is loaded and unloaded.

g) One safety pin with the number 10 is placed into the roller of the mechanism which triggers the 215F initiator from the emergency lever.

Note: Number on ground safety devices correspond with numbers on locations on the seat where safeties are to be placed.

Fastening the Parachute Harness to the Seat and Fitting It to the Pilot

The parachute harness is fastened to the seat as follows (See figure 106):

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a) The shoulder cross strap 3 with the central shackle 7 is fastened to the shoulder harness lock sleeve 12 on the seat; the shoulder cross strap is, in turn, attached to the parachute harness with the harness shoulder straps.

The central shakle 7 is fastened with the elastic cord 8 to the back cushion (See location A).

b) Buckles of the lap belt assembly (on the left and right sides) are fastened to the parachute harness leg straps.

Note: In the future, to standardize parachute harnesses for all types of aircraft, parachute harnesses will be specially (uniformly) equipped with unlatchable locks on the right shoulder strap and with special lap belt and leg strap buckles. [p 485]

The above-mentioned parachute harness fastening devices, i.e., the caprone shoulder cross strap with the central shackle, the elastic cord and lap belt assembly are parts of the seat and are assembled with each seat.

The SK type seat is permitted to be used only with a parachute harness made of caprone cord.

Safety of flights with the SK seat and also of ejection depends to a great extent on a tightly adjusted parachute harness, which on this seat also serves to secure the pilot in the cockpit. Therefore, the parachute harness must be snugged as tightly as possible to the pilot, and the shoulder cross strap must snugly girdle the neck and shoulders with no slack.

When flying with winter gear, the shoulder cross strap may be placed

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on top or under the collar; in both cases, however, it must tightly girdle the neck and shoulders.

General Operating Regulations [p 486]

1. Only those persons who have studied the construction of the seat and who have passed examinations may be permitted to operate the seat.

2. Ejection triggering mechanisms must always be SAFETY-WIRED AND SEALED.

3. Check-out of ejection systems must be performed ONLY DURING REGULATION MAINTENANCE.

During regulation maintenance of initiators, the length of initiators must be measured before they are dismantled. When reaseembled, the initiators must be of the same length as before disassembly, because changing their length will cause seat assemblies to malfunction. Readjustment of seat assemblies is also prohibited.

Removal and reinstallation of the RSM-2500-38 and 215R initiators must be in accordance with instructions in the section entitled "Removal and Replacement of TSM-2500-38 and 215R Initiators."

Assembly and disassembly of initiators must be performed according to the manufacturing plant's technical description and instructions for the operation of the 215R, 215P, 215F, and TSM-2500-38 initiators.

Note: The 215P initiator is disassembled and cleaned without being removed from the seat.

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4. After regulation maintenance is performed, safety-wired systems must be safety-wired anew and sealed. The safety-wire must be of the type specified in instructions.

When removed during 215P initiator disassembly, safety plates of the lock of the initiator three-link collar must be replaced with new ones, because a second bending of plate ends is prohibited.

5. Procedure must be known and remembered. [p 487]

a) If the aircraft is used when the ambient temperature ranges from -50° C to +20° C, then the TSM-2500-38 initiator must be modified for winter operation, i.e., a plug must be installed in place of the bleeder nipple.

b) If the aircraft is used when the ambient temperature ranges from +5° C to +50° C, then the initiator must be modified for summer operation, i.e., the plug must be removed and replaced by a bleeder nipple (from the tool and parts set).

When replacing and removing the plug and nipple, follow operating instruction for the TSM-2500-38 initiator.

c) The TSM-2500-38 initiator is supplied by the manufacturing plant ready for winter use.

When the initiator is modified from winter to summer use and vice-versa, log entries must be made.

6. Removal and installation of the seat must be done with unloaded TSM-2500-38 and 215P initiators.

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7. The 215R and 215F initiators are unloaded after the seat is removed from the aircraft and are reloaded before it is reinstalled.

8. In the event that the canopy or seat are replaced, the cockpit repaired, or any final adjustments made which may affect the coupling of the seat and canopy during ejection, the seat and canopy must be checked out with a special attachment with a stand. This is performed by manufacturer plant technical specialists.

2. Seat Removal and Installation

Before removing the seat, the ground safety devices on the "installation lanyard" must be located in the seat mechanisms, and safety rules must be observed to prevent accidental triggering of initiators.

Note: When the safety pin with the number 2 is inserted into or removed from the 215R initiator actuating lever, be careful not to turn the lever and break the safety seal.

Procedure for removing the seat is as follows:

1. Open the canopy and insert ground safety pins into the rod of [p 488] the left canopy cylinder and into the bell crank of the canopy emergency jettison system. Install the following ground safety pins: number 1 in the RSM-2500-38 initiator, number 8 in the canopy emergency release lever, number 2 in the 215R initiator actuating lever, number 3 in the 215F initiator, number 4 in the 215P initiator, number 10 in the 215F initiator triggering mechanism roller, and number 5 in the hinged supports of the front canopy catches.

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2. To gain access to the breech of the TSM-2500-38 initiator, first safety-wire the holes at the ends of the plates of the stabilizer parachute container, then disconnect the stabilizer parachute with its container and shroud line swivel from the side of the 215P initiator and carefully place it on the seat headrest, but do not remove the shroud line and cover from the recess. Refer to section 5 of this chapter for disconnection of the stabilizer parachute.

3. Replace the number 1 ground safety pin with a flexible pin which should be tied with KO-K 0.5 wire to the breech and unload the TSM-2500-38 initiator.

Unload the 215P initiator.

Refer to section 4 of this chapter for unloading initiators.

4. Disconnect the lanyard of the AD-3U automatic device from the cleat on the fuselage.

5. Disconnect the cable from the control shaft rocker arm of the hinged supports.

6. Disconnect the MU-100AP electric motor.

7. Disconnect the lower block of the ORK-2 disconnect from the seat armrests.

8. Unscrew the support screws of the hooks securing the upper TSM-2500-38 initiator trunnions in the seat beam suspension assemblies. [p 489]

9. Fasten the cable to lift the seat to the seat trunnions and proceed to remove the seat from the aircraft with a hoist.

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10./ Slowly lift the seat and remove the leg support pins from the guides on the cockpit floor. Then, raise the seat higher and free the tracks from the rollers on the fuselage. After removing the seat from the aircraft, place it on its track in the spot prepared for it or put it on a special pyramidal rack.

Note: During removal of the seat, the motor control lever and the canopy control handle should be moved forward or aft as necessary.

The seat is installed in the cockpit in the reverse order of removal from the cockpit.

When installing the seat, observe the following:

1. The seat must be mounted in the cockpit with all ground safety devices on the "installation lanyard" installed in the seat.

2. To facilitate seat installation, secure the leg supports by inserting safety pins.

3. Lower the seat slowly into the cockpit until the upper initiator trunnions rest in the seat catches. Screw in the support screw and safety-wire. When lowering the seat, be sure that the leg support pins enter the guides on the cockpit floor and that the leg clamps are in the unfolded position.

Make sure also that the lower ends of the tracks are inserted into [p 490] the guides on the cockpit floor.

When the seat is being installed, the motor control lever and the canopy control handle should be moved forward or aft as necessary.

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4. After the seat is installed, connect all seat mechanism cables, connect the AD-3U disconnect lanyard to the fuselage, load the TSM-2500-38 and 215P initiators, and secure the container with the stabilizer parachute.

Warning: 1. Before the seat is installed, make sure that the calibrated aperture of the 215R initiator nozzle is not stopped up with grease or dirt.

2. When connecting the cable to the TSM-2500-38 initiator pin, the marine pin should be placed with the head toward the front of the aircraft to prevent the head from touching the initiator trunnion catch bracket bolt.

3. Removal and Installation of TSM-2500-38 and 215R Initiators

A. Removal and Installation of the TSM-2500-38 Initiator

Removal and installation of the initiator is done during regulation maintenance of the seat and initiator with the seat removed from the aircraft.

Before removing the initiator make sure that it is unloaded and proceed to remove it in the following order:

1. Disconnect the cable from the canopy emergency jettison handle to the bleeder valve on the lower part of the initiator. To do this proceed as follows:

a) Remove the safety wire and seal from the valve pin.

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b) Without disconnecting the Bowden cable casing from the container, unscrew the two screws holding the container to the initiator. [p 491]

c) Remove the pin from the bleeder valve and set aside the Bowden cable and bracket.

2. Unscrew bolt 8 holding pin 6 and roller 7 and remove the pin and the right or the left roller (See figure 116).

3. Remove the safety wire and unscrew the two bolts 2 and 3 holding the connecting rod 1 and rocker arm 4 from the left and right sides.

4. Remove the connecting rod from the upper bracket and from the initiator trunnion. Rocker arm 4 remains fastened to the center bracket.

5. Slip the initiator trunnion from the aperture in the second connecting rod and remove the initiator.

The initiator is installed in the aircraft in the reverse order. While installing the initiator remember the following:

a) If when inserting the cable pin into the initiator bleeder valve, the pin will not go into the holes, remove the collar from the valve and through the 3-mm opening move and if necessary turn the valve stem with a screwdriver so as to make pin replacement possible. Then, replace the collar using BF-4 paste.

b) After mounting the bracket with the cable on the initiator, safety-wire the holding screws.

c) After screwing in the screws and bolts in the initiator trunnions and rocker arms, safe-lock them with a plate.

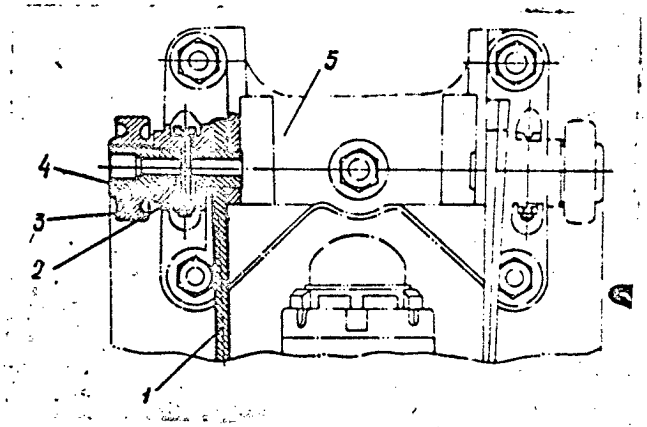
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Fig. 115 Upper Mounting of the TSM-2500-38 Initiator (Key) [p 492]



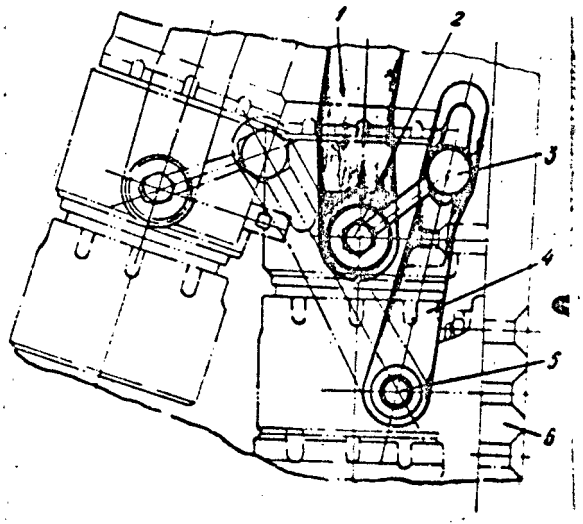
1. Connecting rod
2. Bracket bolt
3. Roller
4. Pin
5. Bracket

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Fig. 116/ Lower Mounting of the TSM-2500-38 Initiator (Key) [p 493]



1. Connecting rod
2. Connecting rod fastening bolt
3. Rocker arm fastening bolt
4. Rocker arm
5. Rocker arm pivot bolt
6. Special plate

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d) Move the lower part of the initiator fully forward and make sure that the pin does not pull out from the valve.

e) Safety-wire the valve pin with MGK-05 wire and seal.

Note: 1. If the installed initiator is modified for summer use, make sure that the calibrated nozzle opening is not stopped up with grease or dirt. [p 494]

2. When replacing the TSM-2500-38 initiator, the distance between the upper and the lower fastener couplings on the trunnion axes must be the same as on the initiator being replaced.

B. Removal and Installation of the 215R Initiator

1. Remove the screws fastening the protective covering of the initiator couplings.

2. Remove the screws fastening cable tube 28 (See figure 107) of the initiator to the upper transverse beam.

3. Unscrew and remove initiator breech 29.

4. To maintain the proper position of the inner tube relative to the upper coupling, draw reference marks on them.

5. Remove the two screws fastening upper coupling 3 of the initiator to the track and carefully remove the tube with the spring and grate bar.

Warning: 1. When unscrewing the second screw fastening the initiator coupling, hold fast to the upper tube to avoid a sudden release of the spring.

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2. If there is an adjustment insert under the upper coupling, place it in exactly the same position when the coupling is reinstalled later.

6. Unscrew the lower cover with roller 31 from the external initiator tube.

7. Check to see that the bleeder nozzle apertures are free from grease, and, if necessary, unscrew the nozzle and wash it.

Note: 1. Manufacturer's instructions for cleaning, disassembly, and checking the initiator before installation on the aircraft must be followed.

8. Assemble and mount the initiator on the seat in the reverse order [p 495] of disassembly.

9. Check for ease of movement and absence of catching in the shoulder harness with the handle on the seat.

4. Loading and Unloading Initiators

Initiators are loaded with two primer cap cartridges.

a) The TSM-2500-38 initiator takes a PK-16 cartridge.

b) The 215P, 215R, and 215F initiators take the PK-3M-1 cartridge.

Initiators are unloaded when the aircraft is transported by railroad, when cartridges are changed, and when checking stricking of primer caps.

TSM-2500-38 and 215P initiators are loaded and unloaded after the seat has been installed in the aircraft.

215R and 125F initiators are loaded and unloaded after the seat has been removed from the aircraft.

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To unload the TSM-2500-38 initiator, the stabilizer parachute must be removed according to instructions in subsection 2 of the section on "Seat Removal and Installation."

To check striking of primer carps, special blank cartridges are used which leave the initiators clean after the check.

Note: If blank cartridges are not available, primer caps in spacers are used. After firing, the breech and chamber inside the cylinder must be cleaned and oiled.

It is forbidden to check initiators without first making certain that they do not contain live cartridges.

Procedures for loading all seat initiators with cartridges are as follows:

Loading the TSM-2500-38 Initiator [p 496]

The TSM-2500-38 initiator is loaded with the PK-16 cartridge in the following order:

1. When disconnecting the cable from the firing pin, unscrew the lock nut from the initiator breech.

2. Unscrew the breech captive nut and remove the breech.

3. To cock the breech, press the stricker with a 6-5-mm diameter pin through the hole in the bottom of the breech body and insert the firing pin.

4. Insert the flexible ground safety pin in the initiator breech after having disconnected it from the "installation lanyard." Tie the pin to the breech with KOK 0.5 wire.

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5. Slip the cardridge on the holding pindle (holding the breech mechanism upside down so that the pin indicating the presence of a cartridge in the initiator is flush with the breech surface) and turn the cartridge around the holding pindle clockwise. Place the edge of the cartridge in the retainer recess.

6. Insert the breech mechanism and the cartridge in the initiator.

7. Tighten the captive nut all the way and tighten the lock screw with a special wrench.

8. After loading the initiator, remove the flexible pin from the breech mechanism and replace it with the ground safety pin with the number 1 on the "operational lanyard."

9. Connect the firing control cable to the pin. [p 497]

The initiator is unloaded in the reverse order, after the flexible safety pin is first inserted into the breech mechanism and tied to the breech with KOK 0.5 wire.

Unloading the 215P Initiator

The PK3-M1 cartridge is used in the 215P initiator (See figure 117) which is loaded as follows:

1. Disconnect the cable from the breech pin (10).

2. Unscrew the stop screw (6).

3. Slightly pull out the initiator inner tube to make the square part of the tube accessible to a wrench.

4. Unscrew the breech lock nut (3).

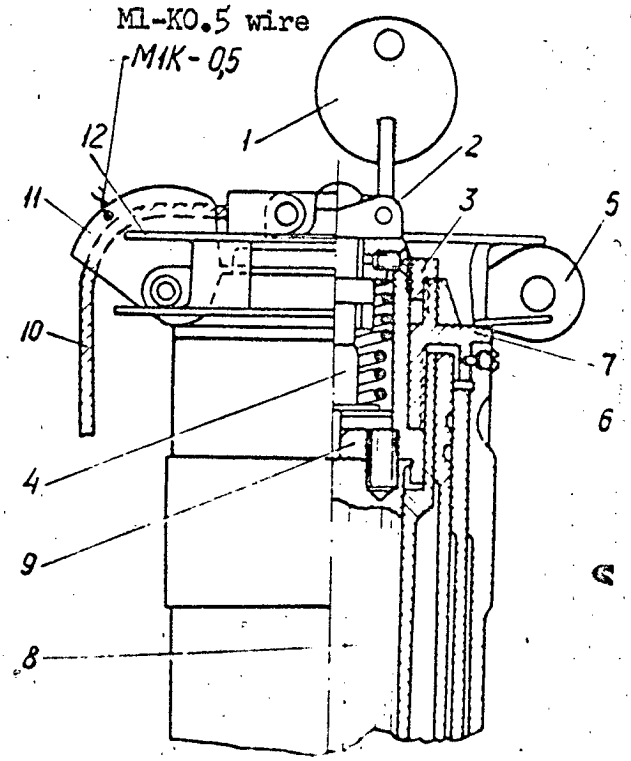
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Fig. 117 215P Initiator Head (Key) [p 498]



1. Ground safety pin.
2. Pin
3. Breech mechanism lock nut
4. Striker
5. Ring with cams and side section plate
6. Safety lock screw
7. Captive nut
8. PK3-M1 cartridge
9. Initiator breech mechanism
10. Pin cable
11. Segment gear
12. Side section plate

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5. Remove the ring with the stabilizer parachute container fastener /(5).

6. Unscrew the captive nut (7).

7. Remove the breech mechanism (9).

8. Through the opening in the breech surface press the stricker with a 4-5-mm pin and insert the pin (2).

9. Disconnect the ground safety (1) from the lanyard and safety-lock the pin.

10. Slip the PK3-M1 cartridge on the pindle on the surface of the breech, and, turning the cartridge, place its edge under the breech pindles.

11. Insert the breech mechanism and cartridge in the initiator tube.

12. Tighten the nut as far as possible. [p 500]

13. Push in the inner tube.

14. Screw in the lock screw.

15. Put on the ring with the stabilizer parachute fastener.

16. Tighten the lock nut.

17. If the initiator is loaded on a seat which has been installed on the aircraft, then the initiator control cable must be connected to the pin.

18. Connect the ground safety pin to the ground safety lanyard.

Unloading is done in the reverse order, after having first installed the ground safety pin.

Loading the 215R Initiator

The PK3-M1 cartridge is used with the 215R initiator.

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The initiator is unloaded in the following sequence:

1. Swing out and the panel on the back of the seat and lock it in the open position.

2. Disconnect the control connecting rods from the lever on the initiator breech and remove the safety wire and seat from the lever.

3. Unscrew the pivot pin bracket fastening screws holding the initiator pin in position.

4. Remove the lever from the initiator pivot pin.

5. Unscrew the captive nut and take out the breech mechanism.

6. Screw the cocking key into the striker.

7. Pull the key and cock the striker, turn the firing pin so that the indicator pin is aligned with the initiator axes. and insert the safety pin which should be removed from its lanyard.

8. Put the cartridge on the breech pindles and insert it into the initiator. [p 501]

9. Replace the lever on the pivot pin and fasten the pin in the bracket. Screw the bracket to the seat track.

10. Screw in the captive nut and safety-wire it.

11. Connect the lever to the control connecting rod and safety-wire the lever to the bracket.

12. Attach the ground safety pin to the ground safety lanyard.

13. Close the panels on the seat bucket. The initiator is unloaded in the reverse order, after the ground safety pin has been installed.

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Loading the 215F Initiator

The PK3-M1 cartridge is used with the 215F initiator. The initiator is loaded in the following manner:

1. Disconnect the connecting rod from the actuating lever.
2. Remove the actuating levers (See caption 16 of figure 121) from the pivot pin of the breech mechanism (17).
3. Unscrew the breech mechanism captive nut.
4. Remove the breech mechanism (17).
5. Cock the striker with the help of a cocking key and turn the firing pin until the indicator is aligned with the breech mechanism axis.
6. Detach the safety pin from the safety lanyard and insert it into the breech mechanism.
7. Place the PK3-M1 cartridge on the initiator pindles.
8. Insert the breech mechanism with the cartridge into the chamber so that the pivot pin enters the retaining fork on the yoke on the chamber. When replacing the breech mechanism note the marking; the breech with the letter P should be placed in the right initiator, and the one with the letter L, in the left initiator.
9. Tighten the captive nut and safety-wire it. [p 502]
10. Replace the actuating lever on the breech pivot pin and cotter it.
11. Attach the connecting rod and safety-fasten it.
12. Attach the ground safety pin to the ground safety lanyard.

Unloading is in the reverse order, after the ground safety pin has been installed.

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5. Seat Height Adjustment

(Figure 118)

When the canopy is closed, there should be a clearance of about 50 mm (regardless of a pilot's height) between the canopy glass and the GSh-4M helmet worn by a pilot when his head is pressed against the headrest.

Therefore, when the aircraft is used by pilots of different heights, the seat must be adjusted according to their height. Adjust the MU-100AP electric motor assembly as follows:

1. Lower the seat bucket to the extreme down position.

2. Loosen the screw fastening the snap ring and move the ring. After locating it in the position which corresponds to the height of the pilot, fasten it with the screw.

3. Lower and raise the seat bucket by placing the switch on the left panel in the "Up" or in the "Down" positions; make sure that the limit switches turn off the motor at extreme positions of the seat bucket.

The aircraft technician must know that:

a) The "86 or less" inscription on the bottom arrow corresponds to a pilot's seated height of 86 cm or less.

b) The "87-91" inscription on the first middle arrow corresponds to a pilot's seated height of 87-91 cm.

c) The "92 93" inscription on the second middle arrow corresponds [p 505] to a pilot's seated height of 92-93 cm.

4. The "94" inscription on the top arrow corresponds to a pilot's seated height of 94 cm.

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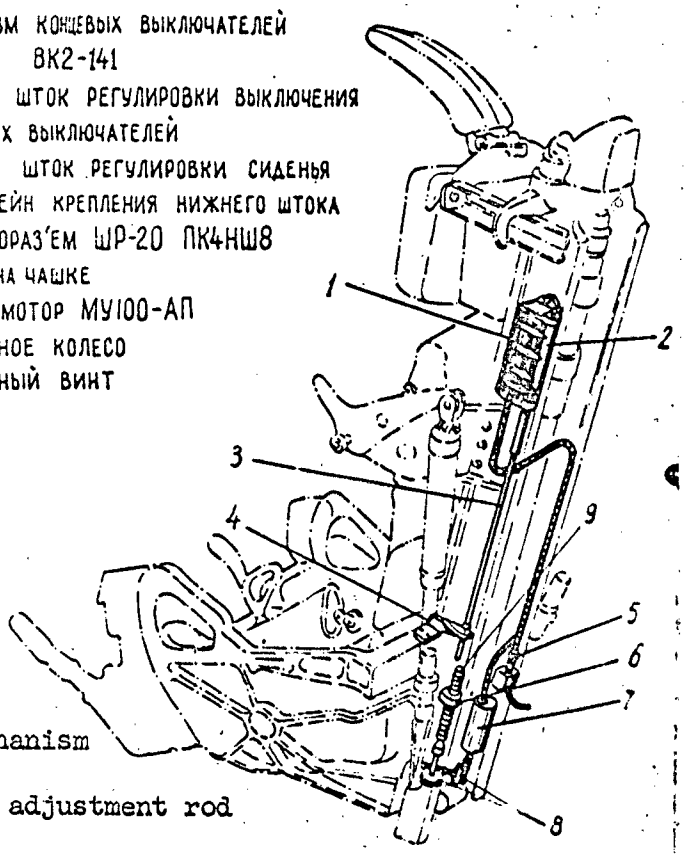
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Fig. 118 Seat Bucket Height Adjustment System (Key)

[p 503]

1 Механизм концевых выключателей ВК2-141
2 Верхний шток регулировки выключения концевых выключателей
3 Нижний шток регулировки сиденья
4 Кронштейн крепления нижнего штока
5 Электроразъем ШР-20 ПК4НШ8
6 Втулка на чашке
7 Электромотор МУ100-АП
8 Червячное колесо
9 Подъемный винт



1. VK2-141 limit switch mechanism
2. Upper limit switch throw adjustment rod
3. Lower seat adjustment rod
4. Lower seat rod mounting bracket
5. ShR-20 PK4NSh8 electrical connection
6. Bucket insert
7. MU100-AP motor
8. Worm gear
9. Jack screw

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[p 504]

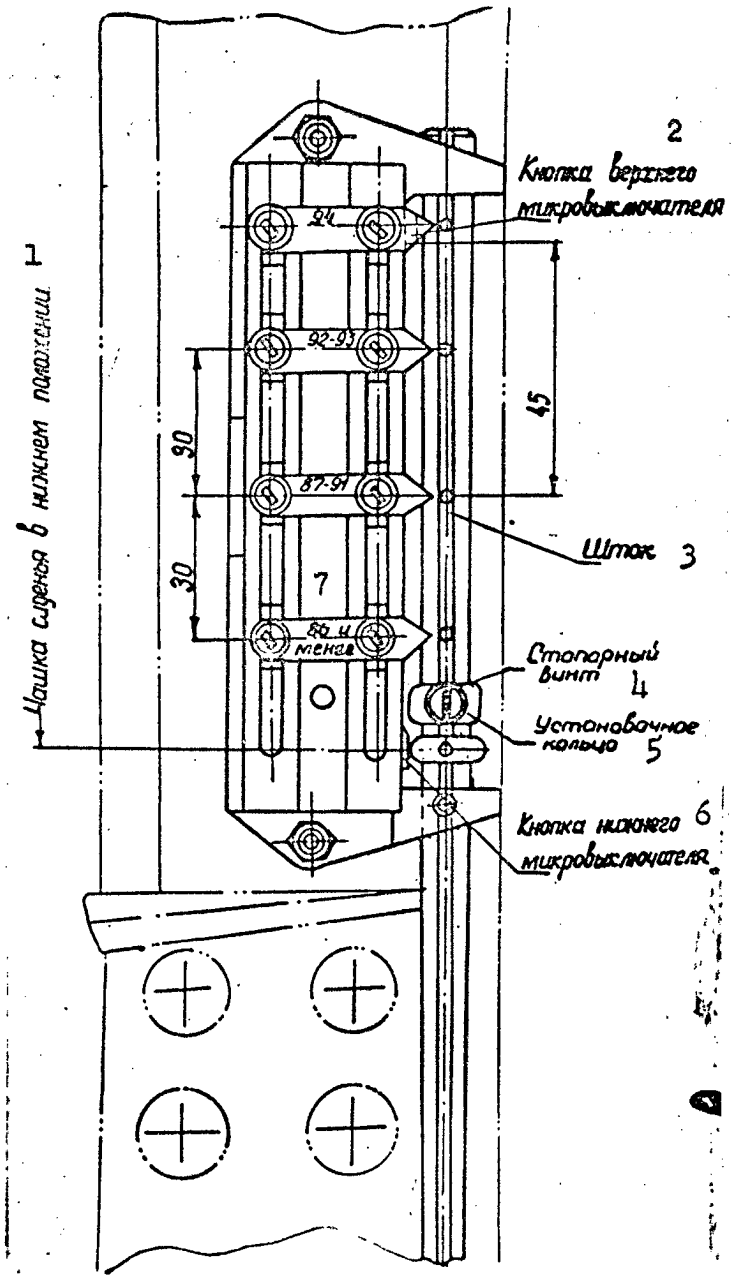


Fig. 119. Seat adjustment mechanism.

1. Seat bucket in the down position
2. Top microswitch button
3. Rod
4. Stop screw
5. Adjustment ring
6. Bottom microswitch button
7. 86 and less

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Note: Seated height (without flying suit and GSh-4M helmet) is indicated in the pilot's medical book.

For example, for a seated height of 90 cm, the snap ring is placed opposite the arrow with the "87-91" inscription; for a seated height of 94 cm, the ring is placed opposite the arrow with the "94" inscription, etc.

5. When the pilot's seated height is equal to 94 cm, place the adjustment mechanism connecting rod snap ring opposite the top microswitch button. The seat bucket then will be in the extreme down position, and it will not be possible to adjust the seat in flight.

Arrows on the adjustment mechanism should always be located according to the dimensions on figure 119.

6. Installing the Stabilizer Parachute on the Seat

A SPK-6381-59 stabilizer parachute assembly is installed on the seat (See figure 120). The parachute and container are sealed with two metal seals.

Removal of the parachute for inspection or replacement is done only during regulation maintenance according to instructions of NIEI PDS [Parachute Landing Service of the Experimental Scientific Research Institute].

Two plates on the container are used to install the parachute on [p 508] the side section of the 215P initiator breech mechanism. Two pins are inserted into the side section and the plates. A swivel mounted on the initiator breech mechanism is connected to the parachute shroud lines by

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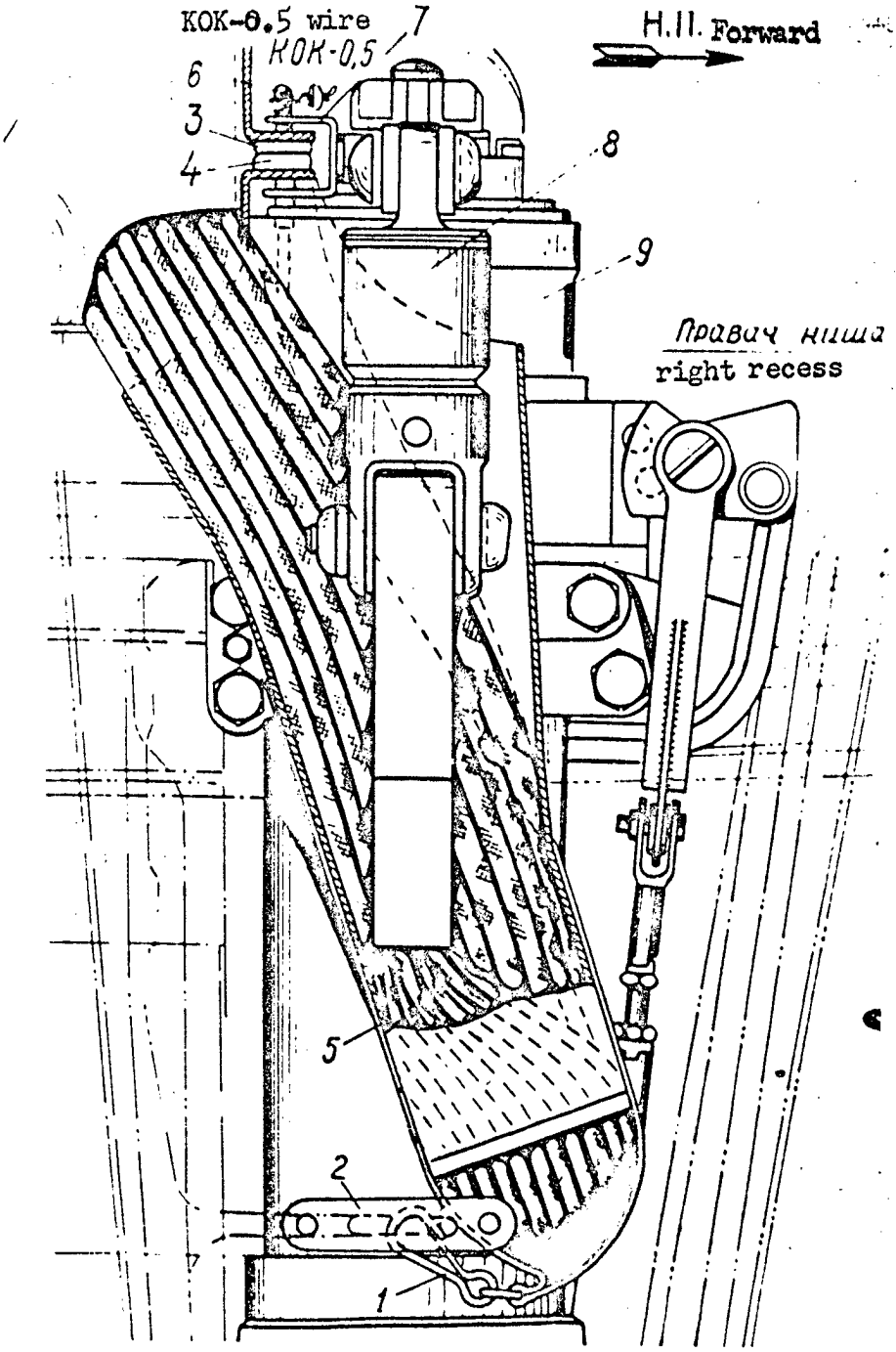


Fig. 120. Stabilizer parachute installation diagram.

1. Shroud bag snap lock connector
2. Clamp
3. Plates
4. Plates
5. Parachute shroud bag
6. Pin (cable terminal)
7. Initiator breech mechanism side section
8. Parachute swivel
9. 215P initiator

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a thimble.

The stabilizer parachute is installed on the seat in the following order:

1. Place the bag with the shroud lines in the right recess of the headrest after having first fastened the snap lock of the bag to the loop in the recess.

2. Attach the parachute shroud line thimble to the 215P initiator breech mechanism swivel.

3. Align the holes in the container plates with the holes in the 215P initiator breech side section and insert the plates in the side section.

4. Place the strap ring between the container plates on the right side and insert two pins in the side section, plates, and ring.

5. Safety-tie the pins with KOK-0.5 wire and seal.

6. Remove the wire and seals from the outer openings of the pack.

Warning: Take-off is prohibited with a sealed container because the container will not release the parachute.

The stabilizer parachute is removed in the reverse order. However, [p 509] before removing the parachute container, unseal it through the outer openings in its plates.

7. Operational Check Out of Seat Assemblies

Operational check out of all seat assemblies is performed only during regulation maintenance on the aircraft. However, NO REGULATION MAINTENANCE

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on the seat is performed at this time because all systems have been adjusted at the manufacturing plant.

Only systems operational capability and striking of all seat initiators are checked.

To check primer cap striking, initiators are loaded with special blank cartridges which leave initiators clean after checking.

Check of systems operational capability and striking of caps is done simultaneously in a given order.

All basic work in checking out the operation of seat assemblies and striking of caps is performed with the seat off the aircraft and on a special pyramidal rack.

Initiators must be unloaded. Complete procedure for checking out the operation of seat assemblies is given below. It must be followed to avoid extra work and accidents.

Operational Check of Firing Systems and of the Cinching Initiator [p 510]

Primer cap striking of TSM-2500-38 and 215R initiators is done at the same time the operation of the firing system is checked.

Proceed with the check as follows:

1. Dismount the TSM-2500-38 initiator from the aircraft and hang it on the seat tying it at the bottom to the seat with wire.

2. Load the TSM-2500-38 and 215R initiators with blank cartridges (primer caps in spacers).

3. Connect the control wire to initiator breech mechanisms and

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replace the safety wire which was removed from the 215R initiator lever during unloading.

4. Slowly depress the trigger on one of the armrests and fire the 215R initiator. When doing this, make sure that at the instant the 215R initiator fires, the TSM-2500-38 initiator pin does not start to move.

5. Then, slowly pressing the trigger still further, fire the TSM-2500-38 initiator, and make sure that there is additional trigger travel after firing.

6. Unload the TSM-2500-38 and 215R initiators and check to see that the primer caps on the blank cartridges have fired.

7. Replace initiator breech mechanisms.

8. Repeat the initiator firing check using the trigger on the other handrest; however, do not check striking of caps.

Note: In the event that either one or both primers are not struck, correct the malfunction and repeat the strike check. [p 511]

Strike Check of 215F Initiator Primer Caps

Striking of initiator primer caps is checked with special blank cartridges as follows:

1. If uncocked, cock the AD-3U automatic timing device in the following order:

a) Remove the roller and disconnect the cable of the AD-3U automatic device from the transverse shaft lever of the seat.

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b) Pull the cord by the ring and hook attached to the automatic device and cock the AD-3U.

c) Insert the flexible pin in the AD-3U.

d) Replace the roller and connect the cord to the transverse shaft lever.

2. Open the guards on the seat and pull out the ground safety with the number 10 from the actuating roller of the system opening the locks securing the pilot. On aircraft where the left transverse shaft rocker arm is safety-locked with a shear screw, remove the screw.

3. Pull out the flexible pin from the AD-3U. The AD-3U will function, pull the cable, and turn the transverse shaft of the seat; connecting rods attached to the shaft will trigger the 215F initiator and fire it. [p 512]

Make sure that the actuating roller of the system opening the locks securing the pilot does not turn and tear the safety wire on the roller.

4. Unload the 215F initiators and check to see that the primer caps of the blank cartridge fired and were struck.

5. Recock the 215F initiator breech mechanisms and replace them in the initiators.

6. Recock, as indicated above, the AD-3U automatic timing device and safety-tie the flexible pin with a string.

7. Turn the seat transverse shaft triggering the initiators back to its original position and attach the connecting rods to the initiator breech

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[p 514]

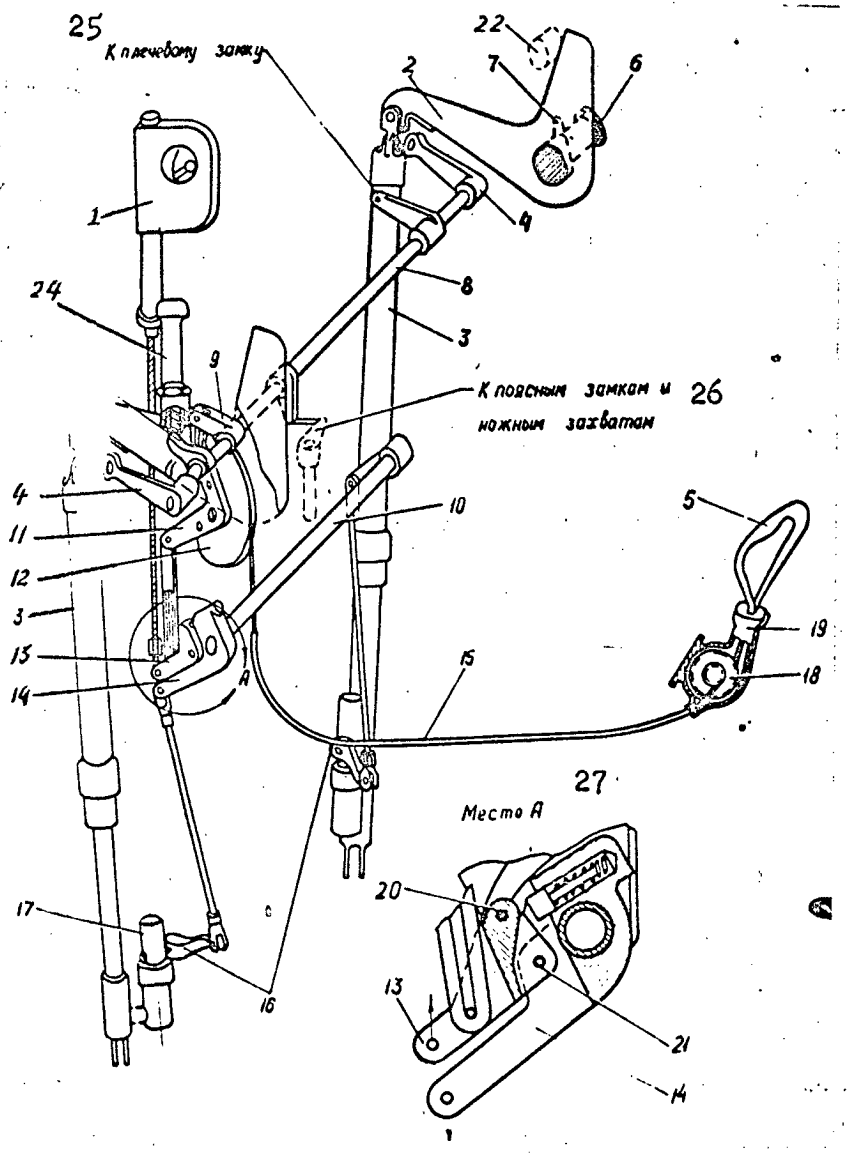


Fig. 121. Kinematic diagram of canopy separation and opening of the locks securing the pilot.

[p 515]

1. AD-3U automatic time delay device
2. Canopy throw bellcrank
3. 215F initiator
4. Transverse shaft lever
5. Hand lever
6. Transverse beam trunnions
7. Trunnion cam
8. Upper traverse shaft
9. Hand lever transverse shaft actuating lever
10. Transverse shaft to the 215F initiator
11. Hand lever drive arm
12. Roller
13. Intermediate lever
14. 215F initiator control lever
15. Hand lever cable
16. Actuating lever
17. 215F initiator breech mechanism
18. Transmission roller
19. Roller frame
20. Lock lever pin (14)
21. Intermediate arm rotation axle
22. Canopy support
23. Rocker arm
24. Spring mechanism
25. To shoulder lock
26. To lap lock and leg clamps
27. Location A

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mechanisms.

Before attaching the connecting rods, make sure that the system is safety-locked by pulling the connecting rods in the same direction which triggers the initiators; the shaft should not turn.

Note: In the event that either one or both primers are not struck, correct the malfunction and repeat the strike check.

Strike Check of the Stabilizer Parachute 215P Initiator Primer Caps

Striking of initiator primer caps is checked with special blank cartridges loaded in the 215P initiator as follows:

1. Connect the cable to the 215P initiator breech mechanism pin.

2. Pull the cable and jerk the pin out of the 215P initiator breech mechanism.

3. Unload the 215P initiator and check to see that the blank [p 513] cartridge primers fired and were struck.

4. Recock and put the 215P initiator breech mechanism back in its place and connect the cable.

Note: In the event that either one or both primers are not struck, correct the malfunction and repeat the strike check.

Check of the Opening of the Pilot's Securing Locks by Operation of the Emergency Handle

The check of the opening of the locks securing the pilot (See figure 121), i.e., the opening of the locks to the shoulder harness, the lap belt,

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and the leg clamps, is also performed after the seat has been removed from the aircraft and placed on a pyramidal rack with initiators unloaded. Check-out procedure is as follows:

1. Place the parachute and parachute harness in the seat bucket and connect them to the shoulder harness and lap belt locks. Remove the number 10 ground safety pin from the roller triggering the opening of the locks securing the pilot.

2. Sit in the seat, put on the parachute harness, latch the central harness lock, tighten the shoulder harness and the lap belt, and close the leg clamps.

3. Sharply jerk toward the body the emergency lock opening handle located on the seat bucket. The handle will remain in the hand while the following occurs:

a) The safety wire on the handle and on the roller actuating the locks securing the pilot will tear.

b) 21SF breech mechanisms will fire.

c) The spring mechanism will function causing the upper transverse shaft to turn, and the shoulder harness, lap belt, and leg clamp locks to open -- the lap belt lock should release last.

4. Remove the parachute and harness from the seat bucket. [p 516]

5. Inspect the spring mechanism rod and replace old lubricant with TsIATIM-201 lubricant.

After the locks are released, return all mechanisms to their original

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position as follows:

1. To replace the handle cable in the roller on the seat bucket proceed as follows:

a) Remove the cover from the transmission roller on the seat bucket.

b) Slip the handle cable with the end cap through the sleeve on the roller body.

c) Bring the cradle under the cable end cap in the roller to the cable outlet on the frame.

d) Insert the cable end cap into the cradle on the roller.

e) Fasten the roller cover on the frame.

2. Detach the connecting rods from the triggering levers of the 215F initiator breech mechanisms.

3. Cock the spring mechanism as follows:

a) Through the opening in the upper nut of the spring mechanism, insert and turn a special cocking tool.

b) Pull the tool upward and compress the spring having pulled the rod inside. Insert a pin in the tool and cotter the spring mechanism.

4. Cock the shoulder harness lock as follows (See figure 122):

a) Detach connecting rod 26 joining the upper transverse shaft lever with the shoulder harness lock opening lever from the lock opening lever by removing the pin.

b) Insert fastener strap 4 in the opening in the shoulder harness [p 519]

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[p 517]

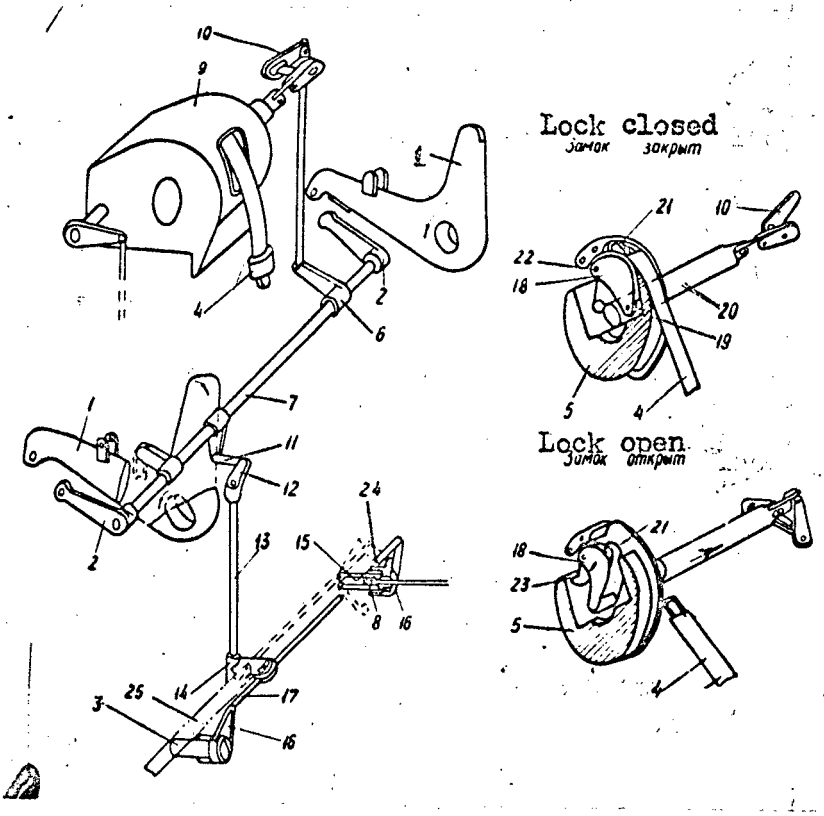


Fig. 122. Shoulder harness lock diagram.

1. Canopy throw lever
2. Transverse shaft lever
3. Lap belt lock
4. Shoulder lock strap
5. Lock cylinder
6. Lever
7. Upper transverse shaft
8. Lap belt cable cap
9. Shoulder harness lock
10. Lock opening lever
11. Actuating rod
12. Vertical shaft lever
13. Vertical shaft
14. Lower lever of the vertical shaft
15. Lap lock latches
16. Lap lock lever [p 518]
17. Connecting rod of the lap lock levers
18. Dog and roller
19. Roller
20. Lock latching rod
21. Boss on dog for guiding cable
22. Dog pin
23. Tail of dog for supporting a screw driver
24. Lock boss on lever for locking latches
25. Connecting link
26. Connecting rod

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lock and push it inside as far as it will go -- the lock cylinder will turn.

c) Through the opening in the body of the lock, press with a screwdriver the tail of the dog with the roller and insert the dog catch in the fastening strap loop. This is the locked position of the lock.

d) Holding the dog with the roller with the screwdriver in this position, push the locking rod into the lock.

e) Make sure that the lock latched by pulling on the fastening strap.

Note: In the event that the strap loop is not caught by the dog catch, turn the lock cylinder toward yourself. To do this, it is necessary to raise the 215R initiator roller rod with the help of the lever and to secure it in this position by placing a wooden block under the rod.

5. To cock the lap belt and leg clamp locks proceed as follows (See figure 123):

a) Open the plates on the seat back to gain access to the above-mentioned locks and secure them in the open position.

b) Turn the lever with the rocker arms of both leg clamps so that the stops mesh with the segment gear.

c) Lift the end levers and turn the upper transverse shaft. The pull rod attached to the lever will move to the left and through a system of connecting rods and levers will turn the rocker arms and bring them

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to the leg clamps.

d) Fasten the units with the buckles on the cables under the parachute harness and insert the cable end caps of the lap belt into the locks on the seat.

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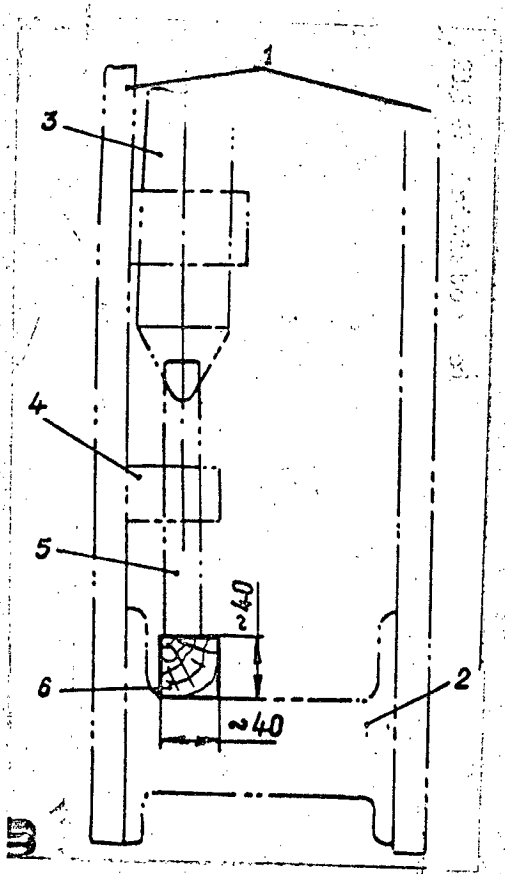


Fig. 123. 215R firing mechanism rod. [p 521]

1. Seat tracks
2. Bottom seat beam
3. 215R firing mechanism [initiator]
4. Rod guide
5. Rod
6. Wooden block

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e)/ Close the clasps of both buckles of the waist belt and [p 522] secure them with special clamps.

f) Move the lateral thrust rod to the left and forward so that the catches cover the openings of the clamps; (Fig. 124) after this, remove the special clamps.

g) Pull on the lap belt to insure that it is secured in the clamps;

h) Turn the upper lateral shaft, again lifting the end catch. At this time the connecting rod, engaging the catch of the vertical shaft, is shifted still farther to the left and the rockers, moving over to the catches of the leg clamps, lock them. The roc50X1-HUMbe in such a position for their contact surfaces to match up with those of the catches.

6. After unfastening the buckle of the shoulder harness, join the control lever with the thrust rod of the upper lateral shaft, and insert the pin.

7. Make certain that the spring mechanism arm stops its plunger in the raised position, and them remove the device for raising it.

8. When the upper lateral shaft controlling the locks of the pilot restraining system and transmission rollers behind the back and on the bottom of the seat is turned, the restrainer cable will be stretched and the rubber part of the restrainer will enter the roller itself; at this time the spring plates with pins must secure the restrainer in its initial position.

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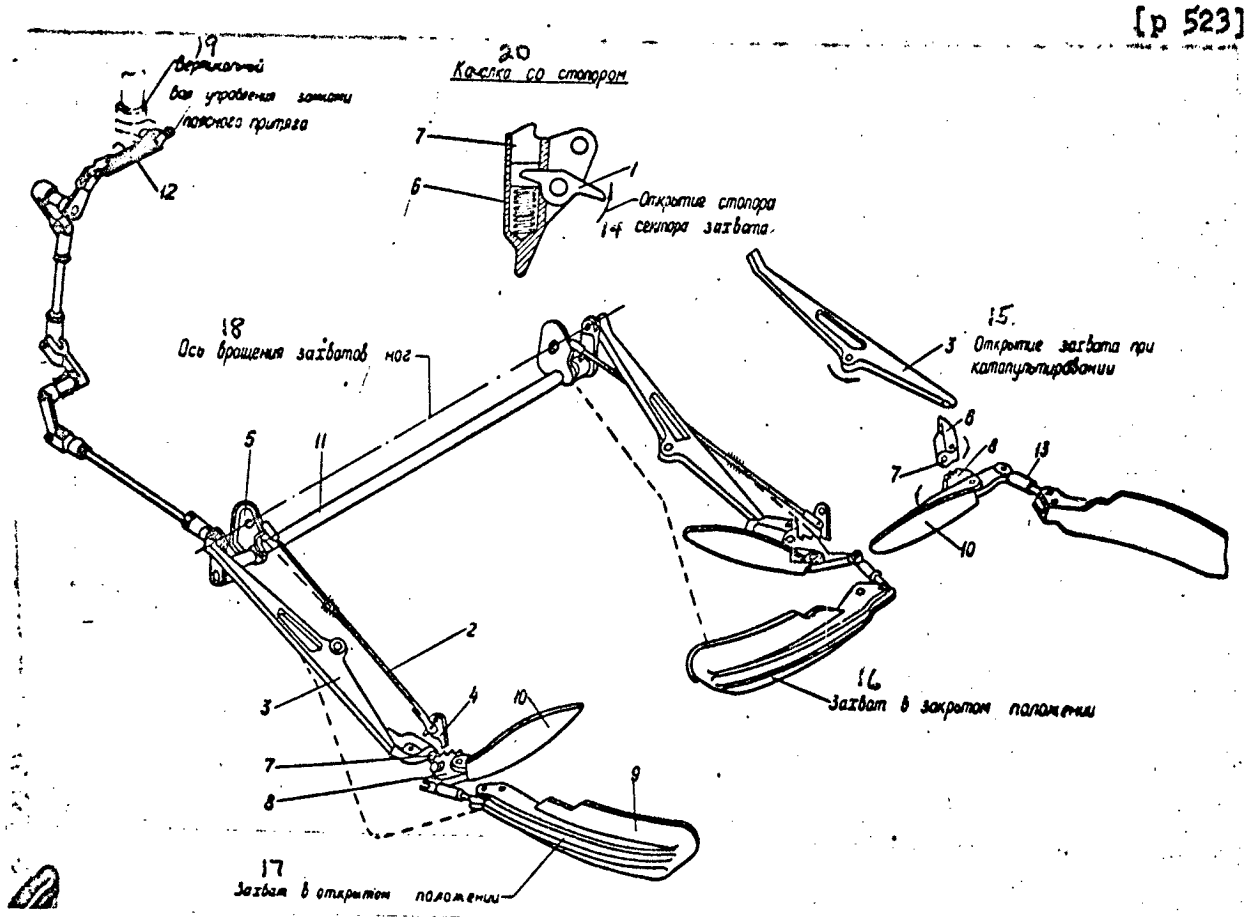


Fig. 124. Leg clamp controls. [p 524]

1. Lever
2. Rod
3. Rocker
4. Safety lock
5. Lock
6. Rocker with lock
7. Lock
8. Ratchet segment
9. Leg clamp
10. Clamp
11. Shaft
12. Connecting rod
13. Thrust rod
14. To open catch of clamp segment
15. To open clamp during ejection
16. Clamp in closed position
17. Clamp in open position
18. Leg clamp rotation axis
19. Vertical control shaft for waist belt mechanism
20. Rocker with lock

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9. Secure with wire KOK-0.5 and seal the right rocker of the [p 525] upper lateral shaft, the handle of the emergency release of the locks restraining the pilot, the lower thrust rod and the drive bearing mechanism for opening the locks restraining the pilot.

10. Close the hinged flaps at the back of the seat and check the operation of the lap belt and shoulder harness from the handles on the hand rests, and also ensure that the leg clamps lock in the open position.

11. Remove old grease from the junctions of all moving parts and apply new TsIATIM-201 graphite grease.

Checking the Operation of the Hinged Keepers under the Canopy Clamps

To check the operation of the hinged keepers, proceed in the following order.

1. Remove the shear lock bolt from the left segment of the shaft controlling the hinged keepers (Fig. 125, inset 20), first ensuring that the ground safety pin "5" is in place in the bearings.

2. Carefully remove the safety pin (ground) from each keeper, one at a time. Turn the shaft controlling the keepers; then open the keepers 90° and secure them with spring pins.

3. Unscrew the shear bolt of the safety locks holding the movable spring pin in the grooves of the keepers, strike the safety lock with a 0.10 mm rod (simulating the bushing of the forward seat clamp lock on the canopy), and then remove the spring pin.

After making certain that it is in good working order, remove the

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spring pin and secure it with the safety lock, screwing in the shear bolt. The check must be made for each keeper.

4. Attach a dynamometer to each keeper to measure the initial folding force, which must not be less than 18 kg. Attach the dynamometer to the lug of the keeper; then to detach the keeper, press on the pin with the rod through the opening above the keeper support bracket and remove it from the opening in the bracket. [p 526]

5. After the measurement of the strength of the springs, the keeper is assembled in reverse order and the ground safety locks are installed.

8. CHECK FOR THE PRESENCE AND CONDITION OF SEALS AND SPECIAL LOCK BOLTS ON THE SEAT MECHANISMS

After making the checks on the operation of the seat mechanisms, check for the presence and condition of the seals and special lock bolts as follows (see Fig. 125).

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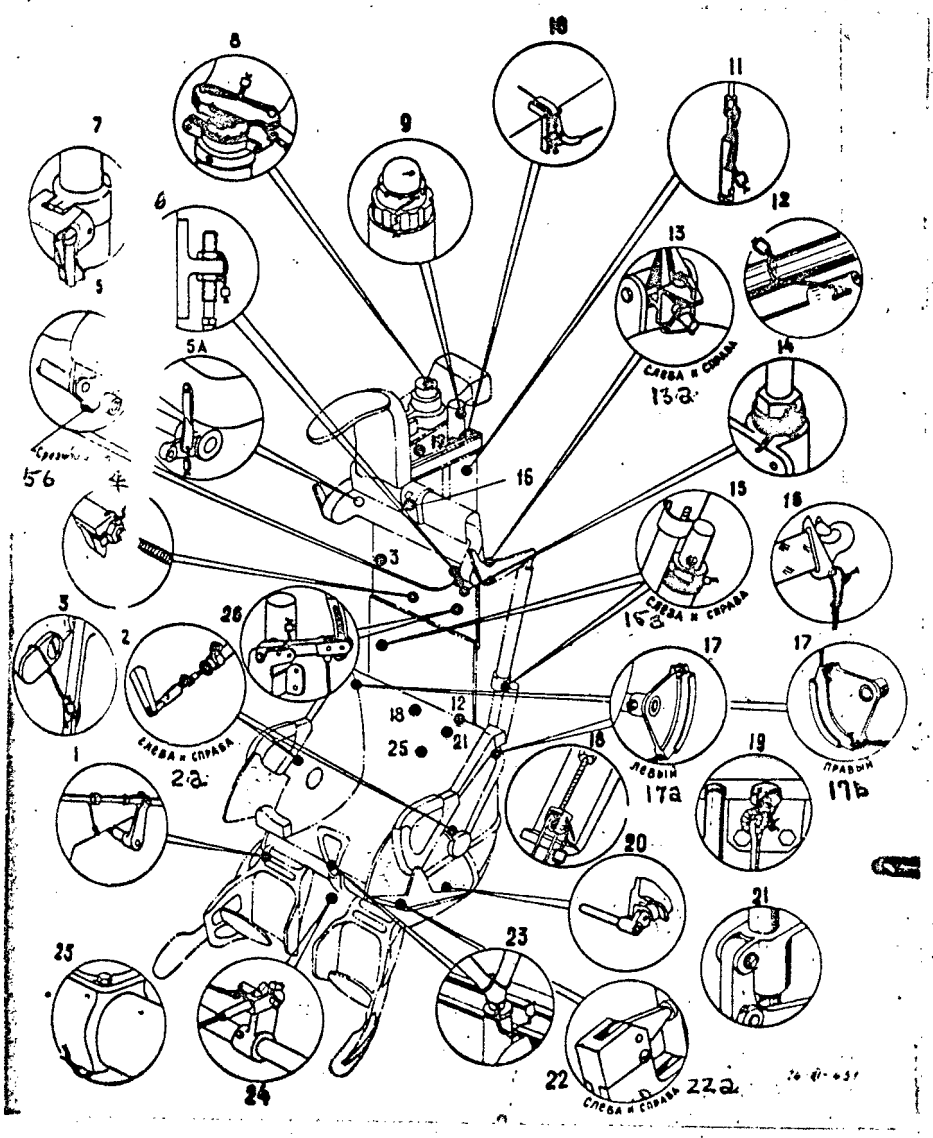


Fig. 125. Seat fixtures.

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1. The thrust rod for opening the leg clamps is secured with wire MIK-0.5 without a seal. [p 528]

2. The terminal for the control cable of firing mechanism TSM-2500-38 is secured with wire KOK-0.5 without a seal.

2a. [Secured] on the left and right

3. The lock to check rotation of the roller during the operation of the automatic AD-ZU mechanism is secured with wire MIK-0.5 with a seal.

4. The thrust nut of the flexible casing of the cable for the emergency lock release system is secured with wire KOK-0.8 with a seal.

5 and 5A. The right lever of the upper lateral shaft controlling the pilot release locks from the assembly No. 1620 is secured with wire KOK-0.5. With mechanism No. 1701 it is secured with shear bolt AMTs-817,Ø.2 mm.

5b. Shear bolt

6. The check nut (terminal) of the cable for iniator 215R is secured with wire KOK-0.5 with a seal.

7. The fastening lock of the three-section collar for firing mechanism [p 529] 215P is secured with two steel-10 shear bolts and two steel-10, L-0.5 fastening plates.

8. The external sleeve with insert of cap assembly 215P is secured with one steel-25 stop screw. The lock pins of the stabilizing parachute and the pin and cable pins of initiator 215P are secured with wire KOK-0.5 with a seal.

9. The lock nut of initiator TSM-2500-38 is secured with wire KOK-0.8 with a seal.

10. The 215P-initiator cable in the groove is secured with wire KOK-0.5 without a seal.

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11. The adjustment rod in the initiator TSM-2500-38 control system is secured with wire KOK-0.8 (left side) with a seal.

12. The horizontal thrust rod controlling the release of the lap belt [p 530] lock is secured with wire KOK-0.5 with a seal.

13. The connecting links on the left and right levers in the bar release control system of the stabilizing parachute are secured with special pins of AMTs-K-2 material.

13a. [Secured] on the left and right

14. The lock nut of initiator 215R is secured with wire KOK-0.8.

15. The lock nut of initiator 215F is secured with wire KOK-0.8 and a steel-25 stop screw.

15a. [Secured] on the left and right

16. The hook holding the shock-absorber cord to the lock on the shoulder crosspiece is secured with wire KOK-0.8 without a seal.

17. The attachment of the cable for the initiator TSM-2500-38 control (by a ball) on the left and right behind the seat bucket is secured with wire KOK-0.8 without a seal.

17a. Left.

17b. Right.

18. The check pin of the initiator TSM-2500-38 release valve is [p 531] secured with wire MIK-0.5.

19. The flexible pin for the firing position of mechanism AD-ZU is secured with a twisted cord, pulled from a bunch of cotton.

20. The left segment of the shaft controlled by the hinged keepers under the forward lock of the canopy is secured by a special shear bolt of AMTs-K-2 material.

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21. The tension check mechanism of the shoulder harness is secured by a shear bolt of AMTs material, diameter 3.5 mm.

22. Two catches (left and right) for checking the advance of the spring pins on the hinged keepers under the forward canopy clams are secured with special shear bolts of material AMTs-k2. [p 532]

22a. [Secured] on the left and right

23. The handle (rubber) of the pilot's emergency lock release system, situated at the bucket of the seat, is secured with wire KOK-0.5.

24. The sleeve for the cable on the rocker of the shaft for opening the hinged keepers under the forward canopy clamps is secured with a shear wire of AMTs-k2 material, diameter 2 mm.

25. The reducer plug of the seat raising mechanism is secured with wire KOK-0.8.

26. The trigger of initiator 215R is secured with wire KOK-0.5 with a seal.

Also ensure that all immovable parts of the seat are locked. [p 533]

After carrying out the checks on the seat mechanisms, it is necessary to clean all initiators 215 and TSM-2500-38 in accordance with the factory instructions (for this operation initiator 215P is not removed from the seat).

NOTE 1. To avoid misalignment of the seat mechanisms, the length of 215F initiators after assembly must correspond to the length of the initiators before disassembly.

2. To avoid disturbing the adjustment of the safety belt system when removing initiator 215R, it is necessary to measure the adjusted position of the chech tip of the cable so as not to disturb the adjustment during assembly of initiator 215R.

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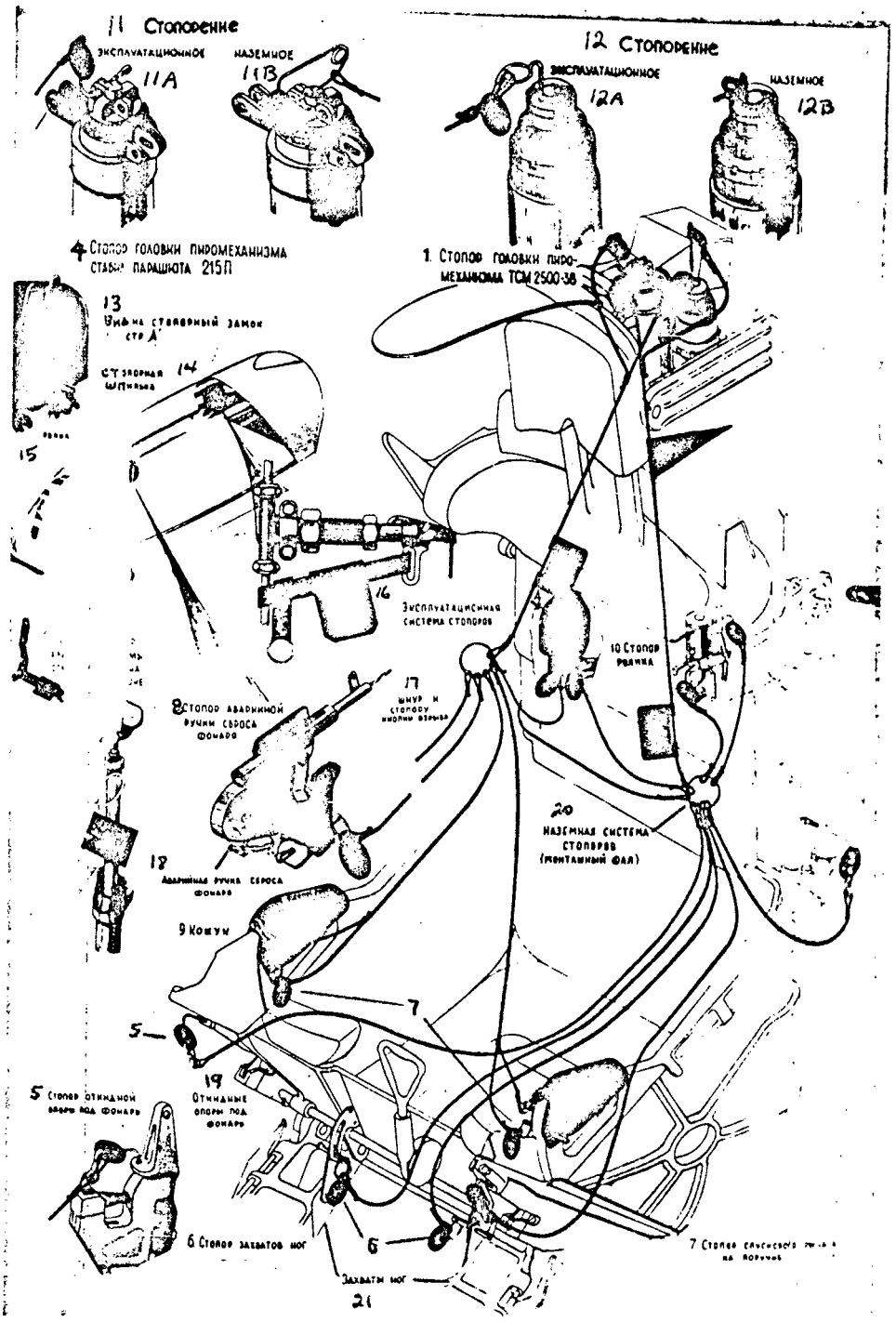


Fig. 126. Arrangement of ground-installed seat and canopy safety locks.

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[Captions to Fig. 126 on preceding page.]

1. Safety lock for cap of initiator TSM-2500-38 [p 534]
2. [illegible]
3. [illegible]
4. Safety lock for cap of initiator 215R of stabilizing parachute
5. Safety lock of hinged canopy keepers
6. Safety lock for leg clamps
7. Safety lock for release lever on arm rest
8. Safety lock for canopy emergency jettison handle
9. Housing
10. Safety lock of roller
11. Safety mechanism
11A. Operational
11B. Ground-installed
12. Safety mechanism
12A. Operational
12B. Ground-installed
13. View of safety lock (see A)
14. Safety lock pin
15. Roller
16. Operational safety lock system
17. Cable to safety lock of firing button
18. Canopy emergency jettison handle
19. Hinged canopy keepers
20. Ground-installed system of safety locks (assembly halyard)
21. Leg clamps

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Load initiators with live charges and install the ground safety locks in them. [p 535]

Check for the presence of safety wires and special bolts on the initiators in accordance with the instructions for operation of the firing mechanisms.

After this, the seat is ready for installation in the aircraft. Assembly of initiator 215R after its dismantling must be done with the aid of "device for arming the spring of 215R" No 74-7804-190A, which is supplied by the factory.

9. List of Jobs Required on the Seat Upon Receipt of the Aircraft From the Factory

1. If the aircraft was transported, remove the seat from aircraft and check for presence of locking pieces and seals.

Unpack the seat if it is packed.

Special care must be taken to keep dirt and packing lubricant out of the calibrated holes in the chambers of initiators 215R and TSM-2500-38, since this can lead to failure of the seat mechanisms during ejection and to excessive stress on the pilot.

The chamber with the calibrated hole is located in the lower part of the initiator. [p 536]

NOTE: Initiator TSM-2500-38 in the "winter" version has a plug without any calibrated hole (solid).

To be sure there is no dirt or grease in the calibrated hole of the chamber of initiator TSM-2500-38 and in the nozzle of initiator of 215R, it is necessary to remove them and, in the case of clogging, clean them in gasoline.

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2. Load initiators with cartridges.

3. If it is not installed, install the stabilizing parachute with container.

4. Install the seat in aircraft.

5. Carry out work on the seat in accordance with "Preliminary Preparations."

10. Preserving the Seat

In the event that work on the aircraft is expected to be interrupted for more than 3 months, the seat must be preserved.

Before preserving, it is necessary to remove the stabilizing parachute and send it to storage in the parachute center.

Before removing parachute, it is necessary to:connect the metal stays sewn into the container with safety wire 0.8 and seal.

NOTE: a) The connections are made through the openings at the ends of the stays.

b) Preserving the initiator is done in accordance with instructions on cleaning, lubricating, maintenance, and care of the ejection firing mechanisms.

Preserving the Ejection Control System [p 537]

1. Cover the entire wire cable with graphite lubricant having a TsIATIM-201 base.

2. Cover the following with a thick layer of TsIATIM-201 grease:

a) all control couplings, especially shaft bearings, to prevent moisture accumulation in the bearings;

b) bolts of the lifting mechanism of the seat bucket and adjusting devices of the limit switch;

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c) seat bucket guides (rails);

d) leg clamp mechanisms

e) mechanisms of the hinged keepers of the forward canopy lock-catch units

f) pins in the upper beam of the rear lock-catch units.

[p 538]

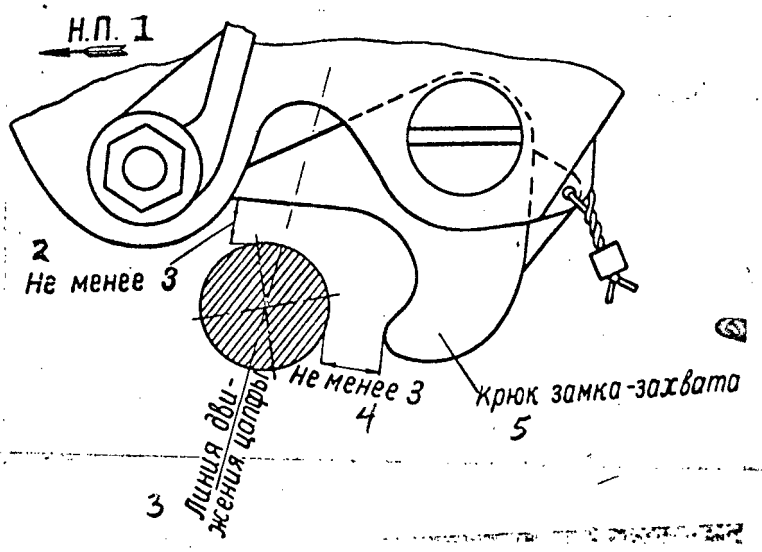


Fig. 127. Diagram showing clearances between the seat pin and the hook of a lock-catch unit.

1. Forward
2. Not less than 3
3. Line of movement of pin
4. Not less than 3
5. Hook of the lock-catch unit

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CHAPTER X

[p 539]

FIRE FIGHTING EQUIPMENT

1. GENERAL INFORMATION

(Fig. 128)

The fire fighting equipment of the aircraft provides for extinguishing of fires originating in the engine bay, whether in flight or on the ground.

The fire fighting equipment consists of a fire warning system and a fire extinguishing system.

The ES-2MS fire warning system provides the pilot with a warning light indicating the start and end of a fire in the engine bay of the aircraft and consists of the following main elements: indicating devices (sensors), an electronic amplifier and a warning light, electrically connected to each other.

Two heat resistant metal tubes (half rings), to which an electric current is supplied, are attached to the underside of frame No 29 and serve as the sensors.

The tubes are secured by brackets with ceramic insulators to frame No 29, with a fixed gap of 15-30 mm from the electrical ground of the aircraft. The signal is remotely activated electrically.

The principle of operation of the ionization-actuated sensor is as follows. The system will not operate with a minimum air gap of 15 mm between the tubes and the electrical ground of the aircraft, and the light labeled "Fire" on the T-6 signal panel will not go on. With

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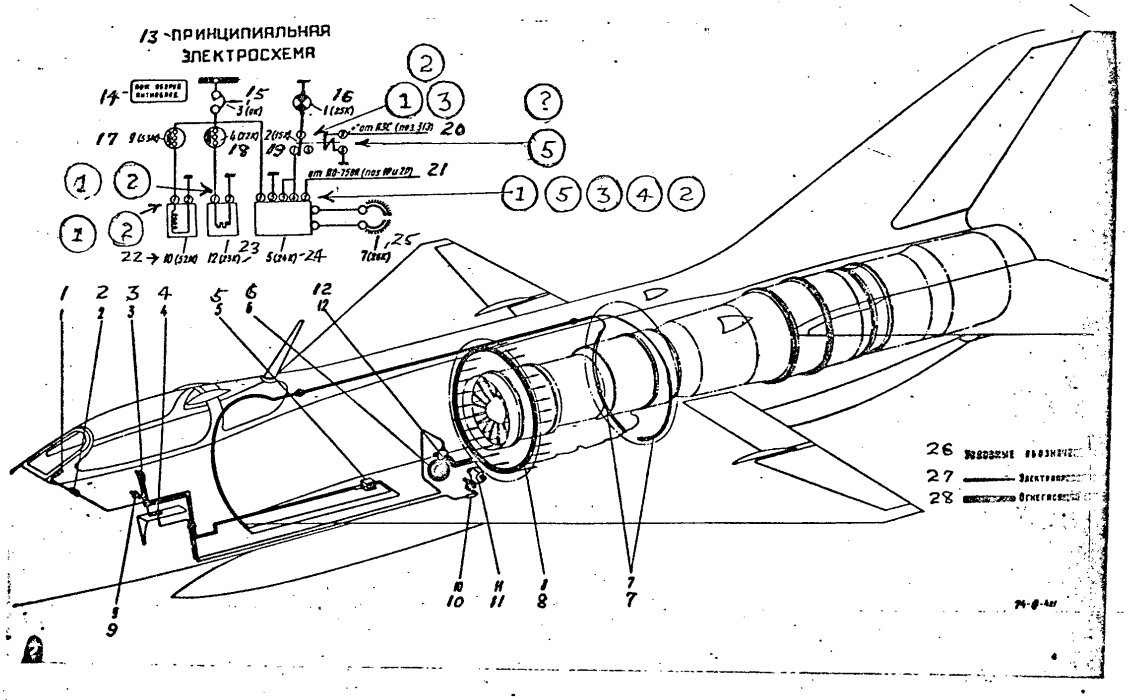


Fig. 128. Fire fighting equipment.

[p 510]

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[Captions to Fig. 128 on preceding page]

1. Warning light [pp 540-541]
2. Control relay for lights of the TKYe-56PD signal panel
3. AZS-5 circuit breaker
4. 205KS fire extinguishing button
5. IS-2MS electronic amplifier
6. 20S-2-1S fire extinguisher tank
7. Fire signaling devices /sensors/
8. Spray-collector ring
9. 204KS engine shut-off valve button
10. 695000M electro-pneumatic valve
11. Fuel shut-off valve
12. Cartridge of the 20S-2-1S fire extinguisher tank
13. MAIN ELECTRICAL CIRCUIT
14. Fire extinguishing and de-icing equipment
15. 3(9K)
16. 1(25K)
17. 9(53M)
18. 4(22K)
19. 2(15K)
20. From the AZS [circuit breaker] (position 313)
21. From the PO-750Ya (position 1R and 2R)
22. 10(52M)
23. 12(23K)
24. 5(24K)
25. 7(26K)
26. Legend
27. Electrical lines
28. Fire extinguishing system

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the appearance of flames in the air space between the tubes and the electrical ground of the aircraft, this space becomes electrically conductive due to the ionization of the air. A difference of potentials occurs which is sufficient to operate the relay located in the electronic amplifier. This relay actuates the "Fire" warning light on the T-6 signal panel. [p 542]

When the fire is extinguished, the "Fire" warning light on the T-6 signal panel will go out.

The 1S-2MS sensor has no lag and operates practically instantaneously.

The fire extinguishing system of the aircraft consists of a special fire extinguisher and a steel spray-collector ring.

The fire extinguisher shown in Fig. 129 consists of a spherical two-liter tank with an electrically activated explosive valve (head valve). The explosive valve of the fire extinguisher is operated by a PP-3 cartridge.

The fire extinguisher is secured to the lower side of the fuselage in the vicinity of frame No 21.

The spray-collector ring is secured between frames No 22 and 23.

Solution "7" is used as the fire extinguishing material.

The fire extinguisher is activated by depressing the button labeled "Fire Extinguisher" located on the left control panel.

Depressing the button closes the circuit of the explosive charge, opening the head valve of the fire extinguisher; the fire extinguishing solution in the fire extinguisher, under pressure of carbon dioxide and [p 544]

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[p 543]

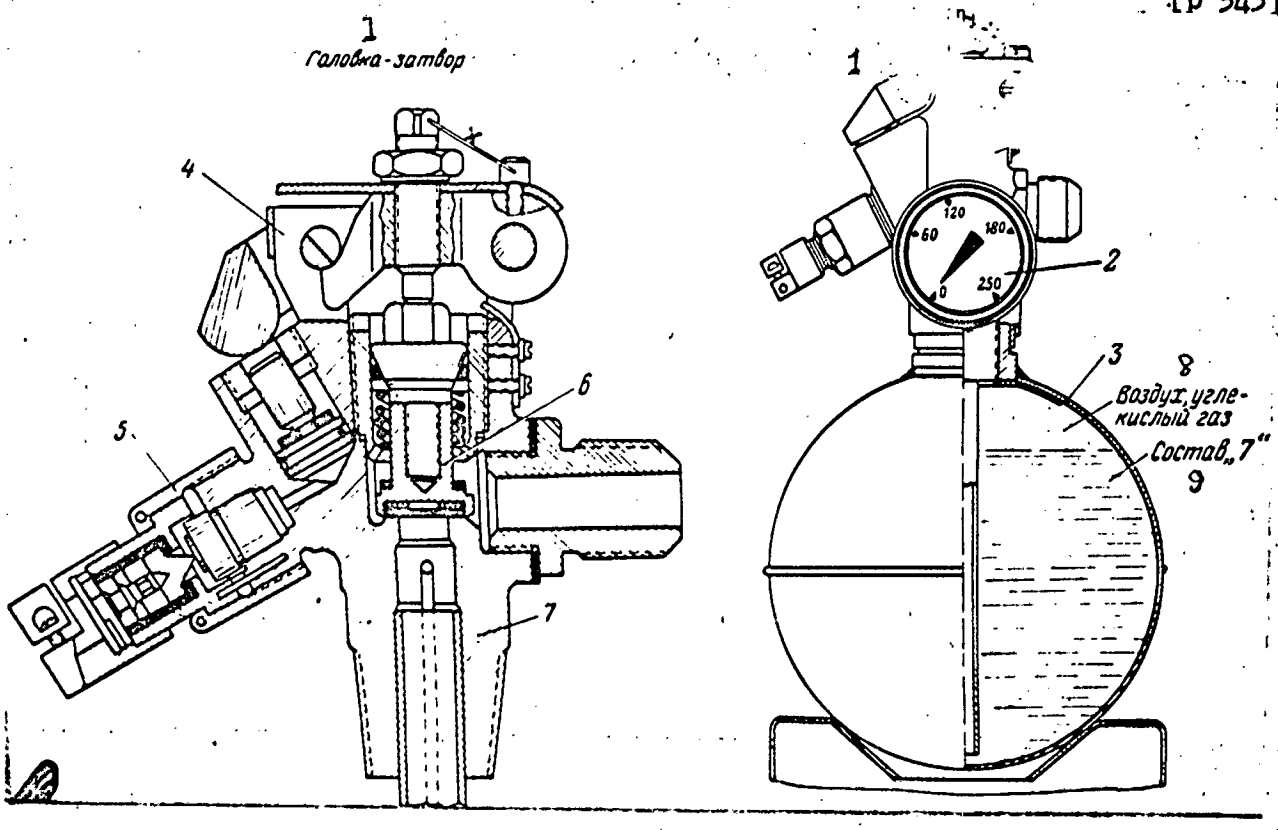


Fig. 129. Fire extinguisher tank with head valve.

1. Head valve
2. Manometer
3. Tank
4. Locking device
5. Cartridge assembly
6. Valve assembly
7. Body
8. Air and carbon dioxide
9. Solution "7"

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air, is forced through the tubes into the collector and into the fire area.

When the red "Fire" warning light on the instrument board of the T-6 signal panel is on, this signifies that the system is in operation.

The head valve of the fire extinguisher is a shut-off valve, by means of which the solution is loaded, stored, and released. The body of the valve has 4 openings for the tubing, manometer, firing mechanism, and safety mechanism for maintaining the pressure at 200 ± 20 kg/cm^2.

Directions for Filling the Fire Extinguisher

The fire extinguisher is filled with fire extinguishing solution "7." Solution "7" is a mixture consisting of anyhdrous carbon dioxide GOST 8050-56, ethylene bromide (GOST 2658-56), and methylene bromide (per VTU). The solution is put in with a local temperature of +15° to +20°C and a pressure of up to 75 ± 5 kg/cm^2, observing safety precautions.

In view of the fact that the basic components in fire extinguishing solution "7" are toxic substances, feeding these substances from special containers into the fire extinguisher must be done under air-tight conditions, forcing them in under compressed air, which is stepped-down from the air pressure in the tank to a gauge pressure of o.5 to 0.6 kg/cm^2.

The anhydrous carbon dioxide and compressed air are fed directly into [p 545] the fire extinguisher tank from the portable tank by gravity or by means of oxygen pump KN-2.

9. Determine the distance between points V and G, which should be equal to 3500 ±20 mm.

10. Determine the distance between points G and D (the full forward travel of the main landing gear), which should be equal to 1310 ±10 mm.

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The oxygen pump goes into operation after the pressure in the portable tanks with the carbon dioxide and air drops below that required and the discharge from/them by gravity stops.

In view of the fact that considerable air pressure is used in filling the fire extinguisher tanks, filling of the tanks with solution "7" must be done with special fittings.

2. Use of the Fire Fighting Equipment in the Aircraft

When using the fire fighting equipment it is necessary to:

Have clean insulators and sensors; otherwise, improper operation can result.

After 50 hours of prescribed operation the insulators and signaling apparatus (sensors) must be wiped with a clean, dry rag. It is permissable to rinse them in kerosene and then wipe them with a clean, dry rag.

WARNING! DO NOT rinse the insulators in gasoline.

2. When using the fire extinuisher, do not: [p 546]

a) drop any gasoline, grease, or water on the head valve;

b) allow anything to hit the tank, valve, or manometer;

v) allow direct heating of the fire extinguisher from heat sources.

3. After use of fire fighting equipment or accidental discharge of the fire extinguisher in the aircraft, eliminate completely the remaining "7" solution from the system, paying particular attention to inaccessible pockets. For this purpose it is necessary to:

a) remove the fire extinguisher from the plane;

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b) drain as much as possible of the remaining mixture from the system and blow compressed air (with pressure of ~50 atmospheres) through the system from the ground tank until all of the mixture is expelled.

To remove the fire extinguisher it is necessary to :

Disconnect the connecting pipe from the main pipeline and attach a plug to the open end (with openings) of the connecting pipe.

Attach plug to the open end of the explosive charge;

Remove the fire extinguisher from its base and send it to be refilled.

All traces of solution "7" should be removed from the compartments of the plane by means of good ventilation and air blown through the ports. The criterion for the complete evaporation of the solution is the absence of any odor in the compartment.

WARNING! Do not in any way wash the compartments of the plane or the fire fighting equipment to remove the surplus solution "7".

4. In the pre-flight inspection it is necessary to check the pressure by the manometer, situated on the head valve, and to keep in mind that for changes in temperature, the pressure in the tank changes: i.e., for an increase in temperature, the pressure in the tank increases, and for a decrease, it decreases, as indicated in the table: [p 547]

°C	-55	-45	-35	-25	-15	-5	0	+5	+15	+25	+35	+45
kg/cm^2 fire ext.	30	35	40	45	50	55	60	65	70	80	90	100

5. When it is necessary to disconnect the amplifier unit, care must be taken not to let moisture get into the cable terminal.

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3. Testing the Fire Warning Circuit

(every 7 + 3 days [sic])

Testing of the fire warning circuit is done in the following sequence:

1. Close the switch labeled "Storage Battery. Aircraft - External," situated on the right panel, and the AZS [automatic circuit breaker] "Fire-De-Icing Switching Valve," situated on the left forward electrical control panel.

2. When a resistance of 5 - 6 megohms is introduced into the air space between the tubes and the electrical ground (fuselage) of the plane, the "Fire" warning light should go on. When a resistance of 8 megohms is introduced, the light should go off.

4. Testing the Resistance of the Insulation in the Electrical Circuit from the Amplifier to the Sensors (during prescribed operation) [p 548]

Testing the resistances of the insulation in the electrical circuit from the amplifier to the sensors is done in the following sequence:

a) Disconnect the double terminal connector from the IS-2MS amplifier;

b) Measure the resistance between terminal KL1 and the electrical ground of the aircraft, and between terminal KL2 and the electrical ground of the aircraft.

The test is made with a megohmmeter (with a range of 500-1000 volts). The resistance should not be less than 20 megohms.

c) Connect the connector to the amplifier.

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5. Charging the Fire Extinguisher [p 549]

The fire extinguisher can be charged with solution "7" using the special equipment shown in Fig. 130 only if name plates are on all the [containers of the] components which make up solution "7".

Charging is conducted inside at a temperature of +15°C. The pressure in the extinguisher tank is built up to 75±5 kg/cm^2. The safety precautions described below must be observed.

The charge consists of the following components in the following quantities:

1. Methylene bromide	2.3	+0.025 kg
2. Ethyl bromide	0.575	+0.025 kg
3. Anhydrous carbon dioxide	0.26	+0.05 kg
Total:	3.135	+0.1 kg

4. Air compressed to 75±5 kg/cm^2.

Prior to charging the fire extinguishers, the following checks must be made:

a) Name plate. The remaining service time of the tank should not be less than 6 months.

b) All units and parts of the head valve are in place and in good condition.

c) The diaphragm is in place and in good condition.

d) There is no water or foreign material in the tank.

The tanks are filled in the following sequence:

1. Close the shut-off of the fire extinguisher and unscrew the

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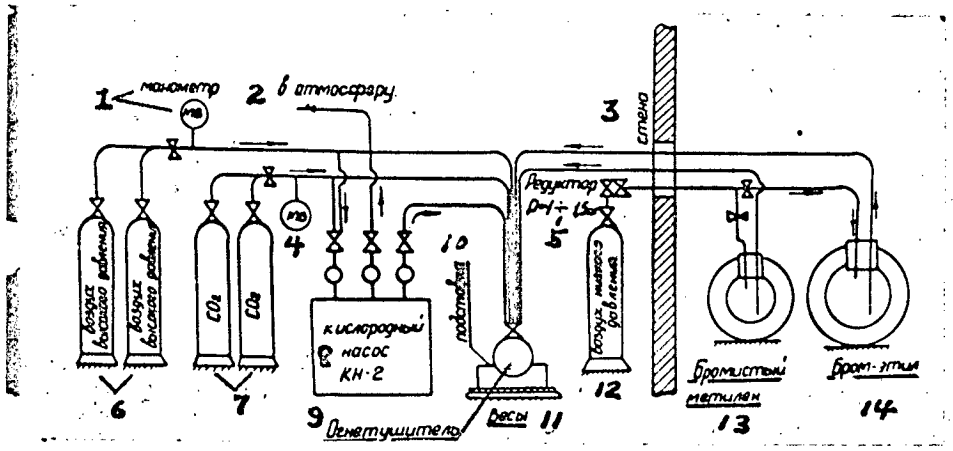


Fig. 130. Diagram of equipment for preparing solution "7".

1. Manometer
2. Exhaust
3. Wall
4. Manometer
5. Pressure reduction valve (1-15 atm)
6. High-pressure air
7. CO_2
8. KN-2 oxygen pump
9. Fire Extinguisher
10. Support
11. Scales
12. Low-pressure air
13. Methylene bromide
14. Ethyl bromide

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clamp screw 5-6 turns with handwheel 2GZ.

2. Remove plug from fire extinguisher.

3. Unscrew connector of safety signalling device.

4. Place empty fire extinguisher (plugs removed) on scales [p 551] in vertical position and determine its weight.

5. Using sleeve nut, attach main fire-extinguisher connection to feed pipe from methylene bromide tank and, if necessary, balance tank in new position.

6. Slide weight on scales to value of required quantity of methylene bromide. Open valve on compressed air tank and cock in methylene bromide feeder line and let methylene bromide enter fire extinguisher until weights are equalized.

7. Close cock in feeder line and valve on compressed air tank. Disconnect feeder line from fire extinguisher and connect feeder line from ethyl bromide tank. Slide weight on scales to value of required quantity of ethyl bromide. Open valve on compressed air tank and cock in ethyl bromide feeder line to fire extinguisher. Let in ethyl bromide until weights are equalized.

8. Close cock in feeder line and valve on low-pressure air tank. Disconnect pipeline from tank; screw in connector to fire extinguisher safety signalling device and slide weight on scales to value of required quantity of carbon dioxide.

9. Connect feeder line from portable carbon dioxide tank, open [p 552] valve in tank and cock in feeder line and let carbon dioxide into fire extinguisher until weights are equalized.

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When there is an insufficient amount of carbon dioxide in the fire extinguisher, pump in the required amount with oxygen pump KN-2.

10. After equilibrium is attained on scales; close cock in feeder line; close valve on portable carbon dioxide tank; tighten clamp screw on fire extinguisher, and exhaust remaining carbon dioxide in feeder line through exhaust valve. Disconnect feeder line from fire extinguisher.

11. Lock scales out of operation; connect feeder line from air tank; open valve on air tank and cock in feeder line; unscrew clamp screw 5 - 6 turns and let compressed air from air tank into fire extinguisher until fire extinguisher manometer shows a pressure of 70-80 kg/cm^2.

12. If pressure in air tank drops below that which will force it into fire extinguisher, use oxygen pump KN-2 to pump air into fire extinguisher until required pressure is attained.

13. Close shut-off valve of fire extinguisher with handwheel 2GZ; close cock in feeder line and valve on air tank, and exhaust remaining air in feeder line through exhaust valve into the atmosphere. [p 553]

14. Disconnect feeder line from fire extinguisher; put cap on open end, and determine (on scales) total weight of charged fire extinguisher.

15. In [fire-extinguisher] charging log enter quantity of solution "7" added, by total amount as well as by individual component, and also pressure in fire extinguisher after charging.

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16. Thoroughly mix contents of fire extinguisher, either in special apparatus or by shaking by hand for 3 to 4 minutes.

17. Verify that charged fire extinguisher is air-tight by applying soap suds to all threaded connections. This test should last at least 3 minutes, during which time no leakage should occur.

18. Place charged fire extinguisher on special stand for 48-hour waiting period.

19. After 48-hour waiting period, check charged fire extinguisher for pressure at manometer and weight of contents on scales, and seal it at clamp screw at top of tank.

20. On name plate of fire extinguisher, record charging data: weight of solution "7" added and pressure in fire extinguisher after 48-hour waiting period.

NOTE: If small excess of fire extinguishing solution "7" is put into fire extinguisher during charging, this excess must be released into the atmosphere as follows: [p 554]

a) secure fire extinguisher firmly, with shut-off in up position (outside bay);

b) by slowly unscrewing clamp screw at top of tank with handwheel 2GZ, exhaust excess from fire extinguisher into atmosphere.

If fire extinguisher charged with solution "7" contains insufficient amount of carbon dioxide, the deficient weight of the carbon dioxide and deficient pressure of air must be added to the contents. Oxygen pump KN-2 can be used for this purpose.

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Correcting deficiency of carbon dioxide and air in fire extinguisher can be done only once. For a continuous loss of pressure in the fire extinguisher of more than 10% below average, the entire contents must be drained and the fire extinguisher recharged, but only after an examination has shown that the head valve is in good working order.

When the fire extinguisher is being charged with solution "7" considerable heat is generated. With cooling, the pressure in the tank drops. It is therefore necessary to make a final check of the pressure in the tank after the 48-hour waiting period.

SAFETY PRECAUTIONS AND SAFE WORKING CONDITIONS DURING CHARGING OF FIRE EXTINGUISHER WITH FIRE EXTINGUISHING SOLUTION "7"

Personnel engaged in charging a fire extinguisher with fire extinguishing solution "7" must observe the safety precautions described here.

1. All work with ethyl bromide and methylene bromide contained in fire extinguishing solution "7" must be done away from open flame, since the products of combustion of the vapors of ethyl bromide and methylene bromide are toxic and can cause severe poisoning. [p 555]

2. Smoking is strictly forbidden in the area in which the fire extinguisher is being charged with solution "7".

3. All personnel engaged in charging the fire extinguisher with fire extinguishing solution "7" must wear Mark "A" gas masks and other special clothing: cotton overalls, rubber boots, rubberized apron.

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4. The building in which the fire extinguisher tanks are being charged with fire extinguishing solution "7" must be fitted with an intake-exhaust vent which guarantees a flow of air in accordance with prescribed standards.

5. Methylene bromide and ethyl bromide containers must be kept in separate areas and tightly closed.

6. When put to use, a fire extinguisher charged with fire extinguishing solution "7" must not be held in the hands, since human strength is not sufficient to handle it when it is discharging.

7. When a fire extinguisher tank is being charged with solution "7," no tool other than special handwheel 2GZ shall be used to tighten the clamp on the shut-off valve.

8. No fire extinguisher shall be charged with solution "7" if [p 556] the tank shut-off is not operating properly, the tank itself is damaged (cracks, badly corroded, etc.), or if a considerable period of time has elapsed since the last periodic inspection of the tank.

9. When a fire extinguisher is being charged with solution "7," it must be firmly secured to the charging equipment.

10. Charging a fire extinguisher with fire extinguishing solution "7" with lock removed is strictly forbidden.

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11. No fire extinguisher charged with solution "7" shall be stored without a cap screwed onto the end of the tank nozzle. The cap serves not only to protect the nozzle from dents and to keep moisture and dirt out of the shut-off valve, but also to guard against violent ejection of the contents during operation and in case of a spontaneous opening of the shut-off. The cap has two openings 3 mm in diameter on opposite sides of the cap. The contents are released through these openings slowly, thus the fire extinguisher does not sustain any sudden shock.

12. Fire extinguishers charged with solution "7" must be stored not less than one meter from any heating element.

6. DISCHARGING THE FIRE EXTINGUISHER

[p 557]

When a fire extinguisher is charged and ready for use, it is sometimes necessary to discharge it, partially or completely. Such a necessity can arise in the following situations:

a) repair of leaky fire extinguisher which has lost part of its contents, and remainder is not sufficient to produce discharge;

b) elapse of guarantee period of tank (The fire extinguisher must be discharged and tank submitted to re-examination by boiler-inspection department.);

v) repair of fire extinguisher necessary, and other cases not covered by instructions.

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When discharging the fire extinguisher, observe the following rules:

1. The fire extinguisher may be discharged only when it is held in a clamping attachment which, in turn, must be secured firmly to a foundation or be of sufficient weight to withstand the shock of discharge of the fire extinguisher without overturning.

2. The fire extinguisher may be discharged only when a cap (with openings) is screwed on the end of the nozzle. The cap is part of the kit.

Even a remainder of the contents may not be discharged unless the cap is on the nozzle and a safety clamp is attached to the actuating lever.

3. Gradually unscrewing the clamp screw with the 2GZ handwheel [p 558] will discharge the extinguisher. The contents will be vented slowly through the openings in the cap, and there will be no danger of an accidental opening of the shut-off valve.

4. A fire extinguisher is always discharged into the atmosphere. Discharging a fire extinguisher in a closed area is strictly forbidden.

5. Before discharging an extinguisher, make sure that no one is within 10 meters of the stream.

6. Gas masks must be worn during the discharging of a fire extinguisher.

7. After the fire extinguisher has been discharged, cover the area affected by the discharge with sand.

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CHAPTER XI

[p 559]

RIGGING THE AIRCRAFT

1. GENERAL INFORMATION

In an operational aircraft, rigging is done only to check the correct operation and symmetry of aerodynamic parts (wings, tail section of fuselage, tail surfaces, landing gear, etc.) following repair or replacement, or on the complaint of the pilot of abnormal behavior of the aircraft in flight.

When rigging an aircraft, keep in mind that the test values obtained for the aerodynamic parts can differ from those of the factory rigging diagram on the fuselage.

Only the deflection angles of the controls (stabilator, rudder, ailerons) are checked on an aircraft which has just been assembled.

Once an aircraft has become operational, it is rigged as indicated in the rigging diagram attached to the aircraft log.

The rigging data are entered in the rigging diagram.

Exceeding the tolerances of the rigging diagram in the direction of smaller deflection angles is not allowed. Deflection angles must be within the limits indicated on the rigging diagram.

Tolerances indicated in the rigging diagram may be exceeded, if the aircraft operates satisfactorily (i.e., the pilot states that there are no [p 560]

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abnormalities in the behavior of the aircraft in flight), and if no evident structural defects are discovered which would impair stability.

Following replacement of any unit and rigging, the test values are entered on the rigging diagram.

Replacement and large-scale repairs of aircraft sections (tail section of fuselage, wings, tail surfaces, etc.) necessitate test flying the aircraft after rigging. If one or two wings have been replaced, rig both wings, flaps, and ailerons; then test fly the aircraft.

Rigging is done according to the rigging diagram attached to the aircraft log. Enter in the boxes the actual test values obtained during rigging.

Rigging is done with fuel tanks empty, no pilot in cockpit, no ammunition or bombs on board, but otherwise full equipment, ports closed, and belly tank attached.

NOTE: No other work may be done on an aircraft while it is being rigged.

To rig an aircraft, secure it in line of flight with jacks under frames 2 and 28 (wheels must be off ground), and place safety jacks under tail section of fuselage at frame 35 and under wings 2 meters from axis of symmetry. There should be a space of 50-60 millimeters between the jacks and the skin of the aircraft. [p 561]

It is recommended that rigging be done in a hangar or, if under field conditions, only when there is no wind and only one rigging condition.

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A level is set at a distance of 3 - 4 meters from the aircraft in such a way that the meter stick can be seen when suspended from any point being checked, including the points on the undercarriage door of the landing gear.

The rigging points on an aircraft are marked with red paint (spot 4-5 millimeters in diameter inside a circle 18-20 millimeters in diameter).

The axis of the fuselage is positioned horizontally along points 1 and 2 on the left side (with respect to line of flight).

Point 1 must be 70 mm above point 2. To assure lateral alignment, the two points 8 must be the same height (within 0.5 mm).

2. CHECKING INSTALLATION OF WING

The rigging angle of the wing $\varphi = 0^{\circ}$; the dihedral angle $V = 2^{\circ}$. The rigging angle relative to the fuselage is determined as follows:

a) In section 7-8-9-10, the difference between points must be: 7 - 9 = 34 (plus-minus 3.5) mm; 9 - 8 = 62 (plus-minus 2) mm; 10 - 8 = 96 (plus-minus 2.5) mm;

b) in section 11-12-13, the differences must be: 11 - 13 = 41.5 [p 562] (plus-minus 3) mm; 12 - 13 = 26.5 (plus-minus 2) mm;

v) in section 15-16-17, the differences must be: 16 - 17 = 10.5 (plus-minus 1.5) mm; 15 - 17 = 22.5 (plus-minus 2.5) mm.

The difference in height of the right and left wings ($U_{ri} - U_{le}$) is

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entered in the rigging diagram with a plus sign for points 8 and 9, 8 and 10, 12 and 13, 16 and 17, if U_{ri} is less than U_{le}, and with a plus sign for points 7 and 9, 11 and 13, 15 and 17, if U_{ri} is greater than U_{le}.

For opposite conditions, the measurements are entered in the box of the rigging diagram with a minus sign.

A plus sign in the box means that, for two given points, the right wing has a larger rigging angle than the left; a minus sign means the opposite.

For each wing, the amount that point 8a must be higher than point 18a is E = 17-32 millimeters.

Asymmetry of dihedral angle V is determined by the amount that points 8a are higher than points 18a of one wing in relation to the other, and this amount must not be more than 10 mm:

$$E_{ri} - E_{le} = E_{le} - E_{ri} \leqslant 10 \text{ mm.}$$

3. CHECKING INSTALLATION OF FUSELAGE TAIL SECTION AND MISALIGNMENT OF FIN

The correct position of the fuselage tail section relative to the nose is determined by measuring the displacement of point 6 (left side of fin) with respect to point 5 (displacement in horizontal plane) and [p 563] of point 3 with respect to point 2 on the left (displacement in vertical plane): 6 - 5 = 210 (plus-minus 5) mm; 2 - 3 = 70 mm.

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Displacement of the fuselage tail section is checked as follows:

Along the axis of symmetry, fix two points (on posts) in front of and behind the aircraft at a height of not more than five meters; stretch a cable between these points and suspend three plumbs from the cable. Line up the first plumb with point 4, the second with point 5, the third with point 6, and determine their misalignment.

The correct position of the fin can also be verified by points 28, 29, 29a and 30.

A twisting of the fuselage can be determined by points 2-2 and 3-3 (left and right). Points 2-2 must not differ by more than 2 mm, and points 3-3 by more than 3 mm.

The tail fin is rigged as follows:

a) In section 26-26-27, the difference of measurements for points 25 - 26 = 14 (plus-minus 2) mm; 25 - 27 = 50 (plus-minus 3.5) mm;

b) in section 28-29-30, the difference for points 28 - 29 = 4 (plus-minus 2) mm; 29a - 30 = 20.5 (plus-minus 3) mm.

The position of the tail fin in the vertical plane is determined by the difference of measurements for points 26 and 28: 26 - 28 = 3.5 (plus-minus 4) mm /3.5 to 4.0 mm ?/.

The position of the ventral fin is determined by the displacement of point 49 from point 48, which must not be greater than 4 mm.

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4. CHECKING THE INSTALLATION OF THE RETRACTABLE CONE AND PROBE OF THE PVD (PITOT-STATIC HEAD) [p 564]

The correct position of the axis of the cone relative to the line of flight is determined by measuring the distances Mv, Mn, Ml, and Mp from point 24:

Mn - Mv = plus-minus 3 mm; Mp - Ml = Ml - Mp = plus-minus 3 mm.

The displacement of the axis of the cone in the horizontal plane is

h = plus-minus 2 mm.

Position of the cone relative to the nozzle inlet:

Cone retracted (position I), Tv = 233 (plus-minus 2) mm; Ti = 223 (plus-minus 2) mm; Tp = Tl = 147 (plus-minus 2) mm. The maximum travel of the cone is 170 (plus-minus 3) mm.

Extension of cone (distance from point 24 to nozzle inlet):

K_1 = 321 (plus-minus 5) mm (position I);

K_2 = 451 (plus-minus 5) mm (position II);

K_3 = 491 (plus-minus 5) mm (position III).

When the cone is in the correct position, the diameter of the nozzle inlet should be D = 663 (plus-minus 2) mm, and the diameter of the cone d = 156 (plus-minus 1) mm. [p 565]

The extension of the cone begins (warning light goes on) when point 24 extends 3-5 mm from the end of the nozzle inlet.

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All measurements are made in the horizontal and vertical planes.

The position of the probe of the PVD is determined by the difference Yu - Ya = 8 (plus-minus 7) mm (in horizontal plane) and Ya - Yu = 43 (plus-minus 7) mm (in vertical plane).

5. CHECKING THE CONTROLS, LANDING GEAR AND BELLY TANK

The deflection angles of the ailerons, stabilators and rudder are measured with a goniometer in degrees perpendicular to the axis of rotation; deflection of flaps, control stick and pedals measured linearly in mm.

The movement of the stick left and right is measured with a goniometer in degrees.

Checking the Stabilators

The rigging angle of incidence of the stabilator $\varphi = 3^\circ$ [?number illegible] and the dihedral angle $V = 0^\circ$.

The position of the stabilator is determined by points 20 and 22.

The rigging angle of incidence of the stabilator is determined by points 19 and 20: v - a = 12 (plus-minus 2) mm.

The deflection angle of the stabilator is measured with a special [p 556] goniometer which is set up on the trailing edge of the stabilator. The scale of the goniometer is set perpendicular to the axis of rotation of the stabilator.

The check is made on the left half of the stabilator.

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The scissors curve of the stabilator is formed by the distance D between points 54 and 55 along the leading edge of the stabilator. For Dl = 0, Dp = plus-minus 1 mm.

The neutral position of the control stick is determined by the distance of point T from the instrument panel, which must be 247-260 mm.

Point T is the usual point at which the pilot grips the stick. The position of point T on the stick is marked by a special ring.

The maximum deflections of the stabilator perpendicular to the axis of rotation are 28° (plus-minus 1°) for the leading edge down and from 11.5° to 15° for the leading edge up, which correspond to stick travel of 196-234 mm toward the pilot from the neutral position and 82-120 mm away from the pilot from the neutral position.

The deflection of the leading edge of the stabilator is determined by measuring the distance D between points 54 and 55.

The maximum deflections of the leading edge of the stabilator are 243 (plus-minus 10) mm downwards and 103 (plus-minus 30) mm upwards.

The Rudder

The distance traveled by the pedals forward and backward from the neutral position is 84.5 - 93.5 mm (measured for the left pedal), which corresponds to a left or right deflection of the rudder of 24-26°.

The correct rudder position is checked by measuring the "scissors" formed by superimposing points 27-47 over points 30-46; the "scissors" must not be open more than 3 mm. [p 567]

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Ailerons

With the control stick in the neutral position, the difference in the deflection of the right aileron (with left aileron in neutral position), i.e., the "scissors," must not measure more than 8 mm. The scissors formed by points 38 and 38a represents the sum of the deflection angles of the ailerons, which should not exceed 16 mm (8 mm for each aileron).

The correct position of the ailerons is checked by measuring the scissors formed by superimposing points 40-41 over points 38-38a (left aileron).

Control Stick and Pedals

Maximum deflections of stick from neutral position:

a) 196-234 mm toward pilot, which corresponds to a downward deflection of the left half of the stabilator of 27-29°;

b) 82-120 mm away from pilot, which corresponds to [an upward] deflection of the left half of the stabilator of 11.5-15°.

Control stick deflection left and right covers 12.5 - 14.5°, which corresponds to a deflection of the ailerons of 19-21° (including booster).

The pedals travel 84.5 - 93.5 mm forward and backward from the neutral position.

Air Brakes

[p 568]

The forward air brakes (left and right) should open 25°, covering 436-456 mm (measure from points 37). The third (after) air brake opens 40°, covering 562-582 mm (measure from points 51).

NOTE: Remove belly tank before opening after air brake.

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Flaps

The flaps deflect 25°. The deflection angle is determined by measuring the distance between points 33 and 34, which should be M = 360-376 mm. The gap between the wing skin and the flap along wing rib 2 should be 48-56 mm.

Landing Gear

For checking the landing gear, plywood sheets are laid and weighted down under the wheels and frame 16.

The check should be made as follows:

1. Make sure landing gear struts are let out completely.
2. Throw two plumb lines over center of outside of each tire.
3. Mark on plywood the projections of the forward and after points of each wheel determined by plumb lines.
4. Bisect lines connecting projected points of each wheel and [p 569] label new points (centers of wheels) A (right wheel), B (left wheel), and V (nose wheel).
5. Connect points A and B with straight line.
6. Drop plumb line from point on axis of frame 16, which lies in plane of symmetry of aircraft. Label projection of this point G.
7. Through points V and G, draw straight line until it intersects line AB, and lable point of intersection with letter D.
8. Measure gage of landing gear (distance between points A and B), which should be 2,672 - 2,712 mm.
9. Determine distance between points V and G, which should be 3,480 - 3,520 mm.

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5. Deflect stabilator to full down position of leading edge.

6. Remove tail fairing after having removed screws from anchor nuts for fastening drain line.

7. Disconnect six fittings fastening removable section of fuselage bay; disconnect two hydraulic lines and pull out front ring with hydraulic nozzle-segment actuators.

8. Disconnect afterburner drain line.

9. Remove brake parachute container, container cover, shield fairing and shield.

10. Remove frame MRP-56P (for access to thermocouples).

11. Disconnect and remove four thermocouple sensors from sleeve.

12. Disconnect both lines from engine afterburner.

13. Disconnect pressure line to main fuel system tanks (left access panel). [p 571]

14. Disconnect four hydraulic lines at valve connection and two air lines after having bled off pressure in hydraulic and pneumatic systems.

15. Disconnect two stabilator and rudder control rods in fairing.

16. Disconnect electric and radio lines.

17. Unlock roller fasteners on engine extension tubes along frame 36 (see Fig 132).

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NOTE: Tie a clean cloth or cellophane over the electric and hydraulic connections to avoid fouling.

18. To remove after section of fuselage:

a) unscrew 18 nuts from joint pins on bulkhead 28;

b) insert knock-out rods in access openings on horizontal members along right and left sides and, using rods as levers, carefully pry after section back.

WARNING:
1. When backing-off after section of fuselage, make sure that no part of fuselage comes into contact with engine, otherwise damage may result.
2. When after section of fuselage has been backed off about 200 mm and extension retaining rollers have slipped off rails, remove the rollers to allow after section to pass beyond nozzle segments.

Assembly of fuselage is done in the reverse order. When assembling [p 572] the fuselage, be sure to tighten the nuts at joint on bulkhead 28 uniformly, i.e., tighten nuts diametrically opposite each other and in a crisscross fashion.

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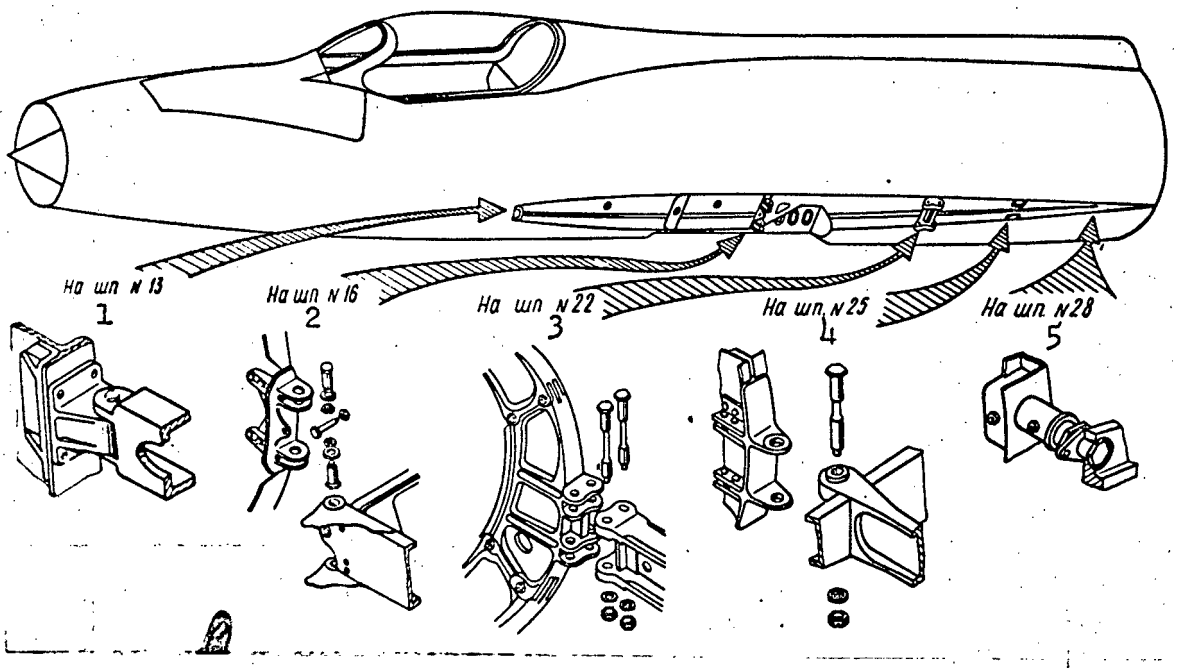


Fig. 131 Wing fastenings.

1-5. On frames 13, 16, 22, 25, and 28.

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In mating the fuselage, electrical connections in the back fairing, in the vicinity of bulkheads 25-28, are made in strict accordance with instructions printed on cover.

In stowing the electrical connections in the cover do not twist bundles. Stowing of free lengths of bundles and whipping about of bundles is also to be avoided. Free lengths of electric bundles must be stowed in loops away from the electrical connections.

When closing the recess cover, care must be taken that the groove fitting over the control rods is not twisted.

After mating fuselage, check operation of the fuel system, the aircraft controls, and apparatus located in the aft fuselage section.

2. Wing Dismantling and Assembly

The wing is fastened to the fuselage by five fittings on bulkheads 13, 16, 22, 25, and 28 (Fig. 131).

Dismantling wing is done in the following sequence:

1. Lower flap (for access to fitting on bulkhead 28).

2. Drop pressure in hydraulic system to zero by using manual control.

3. Drop pressure in pilot's oxygen system and the engine oxygen supply (only when removing left wing).

4. Drop pressure in air system to zero. [p 574]

5. Remove the wing root fairing at front and center of wing.

6. Open access panel in front of wing near fuselage.

7. Raise aircraft until wheels are off ground and run trailer under wing being removed.

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8. Disconnect aileron rods from rocker arm after unbolting wing.

9. Disconnect emergency main-gear uplock release cable (to disconnect roller on the wing).

10. Disconnect and cap hydraulic and air system ducts.

11. Disconnect and cap wing-cell tank fuel line. Fuel must be drained beforehand.

12. Disconnect and cap oxygen system lines.

13. Disconnect electrical and radio connections.

14. Remove cotter pins and nuts from wing bolts.

15. Remove bolts fastening wing to fuselage using stripping tool.

WARNING: In the unit on bulkhead 16, first remove the lower vertical bolt and then the horizontal one. After removing these two bolts, remove the upper vertical bolt using the special key. Lastly, remove the unit from bulkhead 16.

16. Carefully withdraw the trailer with wing while shaking end of wing slightly.

Wing assembly is done in reverse sequence using special tools. [p 575]

After mating wing, check operation of control units, landing gear, and all systems and assemblies in the wing.

3. Stabilator Dismantling and Assembly

When removing stabilator (left or right half), the following is necessary:

1. Open access panel between stabilator ribs 2 and 2A.

2. Remove upper and lower fairing from stabilator.

3. Tilt leading edge of stabilator down as far as possible and open access panel in leading edge.

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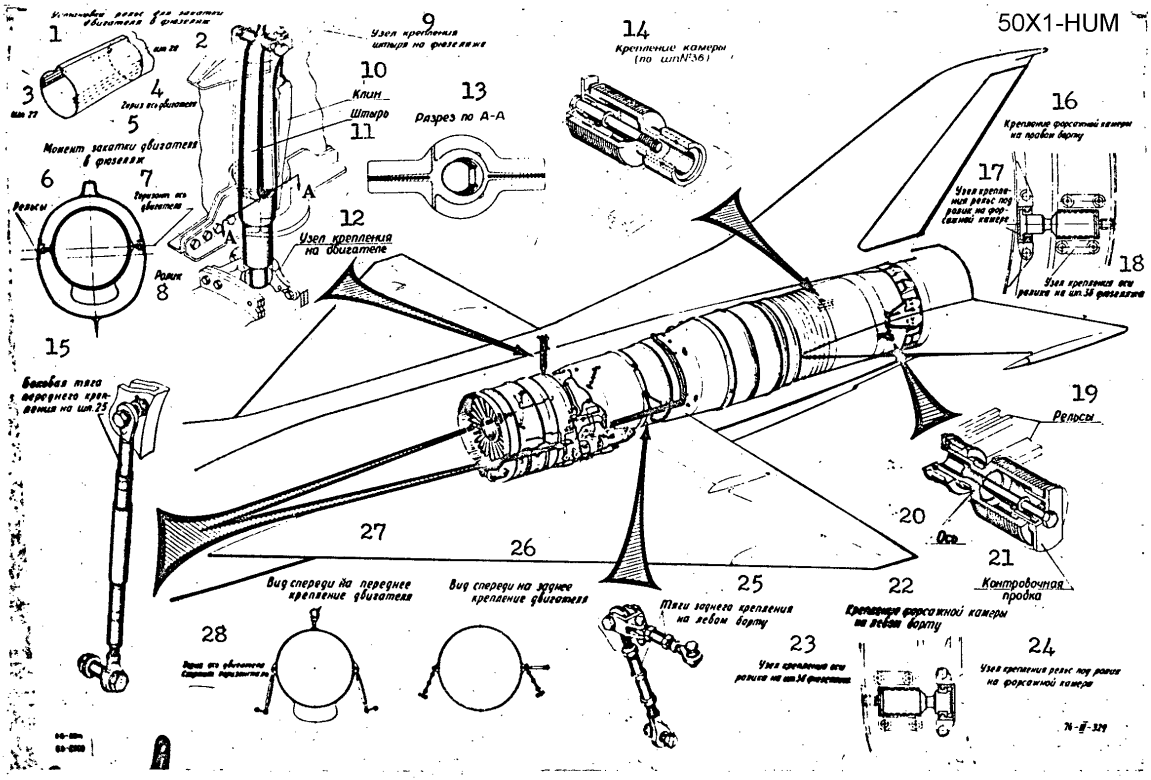


Fig. 132 Engine mounting

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Fig. 132 Engine mounting

[Key to Fig. 132 on preceding page]

1. Rail unit for rolling engine into fuselage
2. Bulkhead 28
3. Bulkhead 22
4. Horizontal axis of engine
5. Moment of rolling engine into fuselage
6. Rails
7. Horizontal axis of engine
8. Roller
9. Unit for fastening shaft to fuselage
10. Wedge
11. Shaft
12. Unit for fastening shaft to engine
13. Section through A-A
14. Afterburner fastener (bulkhead 36)
15. Side bracket of forward mount on bulkhead 25
16. Right afterburner mounting
17. Unit for fastening rails under roller on afterburner
18. Unit for fastening roller axle on bulkhead 36
19. Rails
20. Axle
21. Locking cap
22. Left afterburner fastener
23. Roller axle
24. Unit for fastening rail under roller on afterburner
25. Left rear mounting brackets
26. Front-to-rear view of engine mounts
27. Front view of forward engine mounts
28. Horizontal engine axis.

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4. Remove horizontal bolts fastening stabilator to post.

5. Remove lock fasteners on upper and lower skin (8 pieces), unscrew vertical bolts (4 pieces), and remove bolts with internal threads (4 pieces).

NOTE: The bolts have match marks. The first bolt is closest to the fuselage.

6. Remove stabilator from post, shaking it gently.

Installation of stabilator is done in reverse order.

4. Removal and Installation of Engine

Removal of engine from aircraft is done in the following sequence (Fig. 132) after taking preliminary precautions for its internal protection according to instructions on engine operation:

1. Close fuel shut-off valve [p 577]

2. Disconnect aft section of fuselage.

3. Open hatch giving access to engine.

4. Remove afterburner from engine.

NOTE: 1. When removing engine afterburner ducts which are fastened to afterburner hydrodrive housing, shift plate with hydraulic line connectors and remove before disconnecting fuselage and install after connecting fuselage.

2. Removing the rollers holding the afterburner is done by shifting the aft fuselage section backwards 80-100 mm after the left flanged-roller comes out of the guide-rail fastening.

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5. Through bottom hatch, disconnect following units from engine on right side between bulkheads 22-25:

a) connections of electric bundles leading to engine;

b) engine oxygen ducts;

v) aircraft engine control rod (from lever on engine).

6. Remove fairing (and right air exhaust duct from discharge pocket of fairing) and air-bleed duct at rear bearing housing.

7. Through right lower hatch, disconnect the following at bulkhead 25:

a) benzine hose from electromagnetic valve to engine;

b) drain lines from two "spiders" underneath on load-supporting beam;

v) hose and two lines from right hydraulic pump NP-34-2T; [p 578]

g) power leads from generator-starter socket;

d) generator-starter air-tube (remove).

8. Disconnect following on left side between bulkheads 26-28:

a) hose and two lines from hydraulic pump NP-34-2T (left);

b) pressure lines to fuel system near bulkhead 27 at check valve.

9. Remove fairing and left air exhaust duct from discharge pocket.

10. Through left lower inspection panel, disconnect engine supply lines from duct supplying fuel to pump mounted on engine (do not remove clamps from flexible hose).

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11. Disconnect cabin supply duct at engine.

12. Remove wing back-fairing from above near bulkhead 25; unscrew bolt holding upper engine brace to fuselage; loosen and withdraw brace.

13. Run special trailer to engine and fasten engine to it.

14. Unlock and disconnect two forward engine braces (bulkhead 25) from fuselage.

15. Unlock and disconnect two left and one right auxiliary engine braces (bulkhead 28) from fuselage.

16. Remove engine from fuselage by rolling trailer back.

WARNING: 1. When passing fuel-oil heat exchanger through bulkhead 25, carefully maintain spacing, above and below, between structural units and engine. Move engine carefully, permitting no part of it to touch fuselage members or mounts. If necessary, raise or lower engine on trailer. [p 579]

2. To insure proper installation of engine without need of subsequent rigging, do not remove long side bracket rods along with engine.

3. When removing engine, cap all hydraulic lines with special caps provided, and cover compressor and air intakes. Wrap all electrical connections with clean cloth or cellophane.

4. To prevent corrosion of fuel system units, external protection of engine parts must be done within three hours after fuel is drained.

Install new engine in aircraft as follows:

1. Unpack new engine and remove all external protective covering in accordance with instructions on engine operation.

2. Place engine on trailer.

WARNING: When lifting and installing engine, make sure that hydraulic lines are not damaged and that cables and hoist fittings do not touch engine parts.

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3. Install the following on the new engine (from old engine or from stock):

a) 2 hydraulic NP-34-2T pumps (if of sufficient power);

b) engine brace rods;

v) 2 tachometer transducers (install high-pressure rotor transducer on installed engine);

g) oil pressure transducer;

d) two connecting pipes with screen from air outlet of discharge pocket;

e) connecting pipe of oil-system centrifuge;

zh) connecting pipe for cabin air supply;

i) connection with bleeder valve for fuel-pump line;

k) fuel system drain lines;

l) flange ring on engine intake;

m) oxygen supply line to engine;

n) guide for fastening movable plate to hydraulic line connectors (guide must fasten plate so that edge of front connector is 8 + 1 mm from front edge of notch in guide sections).

4. Before installing engine, check cleanliness of oxygen ducts to engine.

5. Install engine in reverse order of removal. When installing engine, observe gaps between engine and inside skin of fuselage, and between hydraulic lines and units mounted in engine bay.

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Check the accuracy of installation, reliability of fastening and [p 581] retention of shape of the dump chamber nozzles, sealing of the feed line connections, etc. Check the air-bleed nozzle connections from the engine dump chamber to the aircraft nozzles.

When installing the engine, check positioning and possible crimping of the rubber section of the nose seal. Check the position of the metal ring between the air-air heat-exchanger section and the nose of the engine (Fig 133).

WARNING: Do not connect the oxygen feed line.

6. Install the extension tube in the reverse order. Unscrew the fastening rollers to a distance indicated on the roller access hatch covers.

When installing the rollers (during fuselage assembly) into the bracket collars, calculate the dimensions B and V from the end of the collar plane (not from the end of the bracket housing plane). Correct and incorrect methods of measuring B and V are given in Fig. 134.

All the dimensions in Fig. 134 depend on the accuracy of the dimensions B and V, which likewise prevents the possibility of the afterburner chamber touching the fuselage when hot, and the possibility of the right roller leaving the track or jamming.

It is necessary to remember that using dimensions and clearances other than those indicated in Fig 134 can lead to deformation of the afterburner chamber, disengagement of the right roller from the track, and a "buzzing" [p 583] of the aircraft (resulting from contact of afterburner chamber and fuselage).

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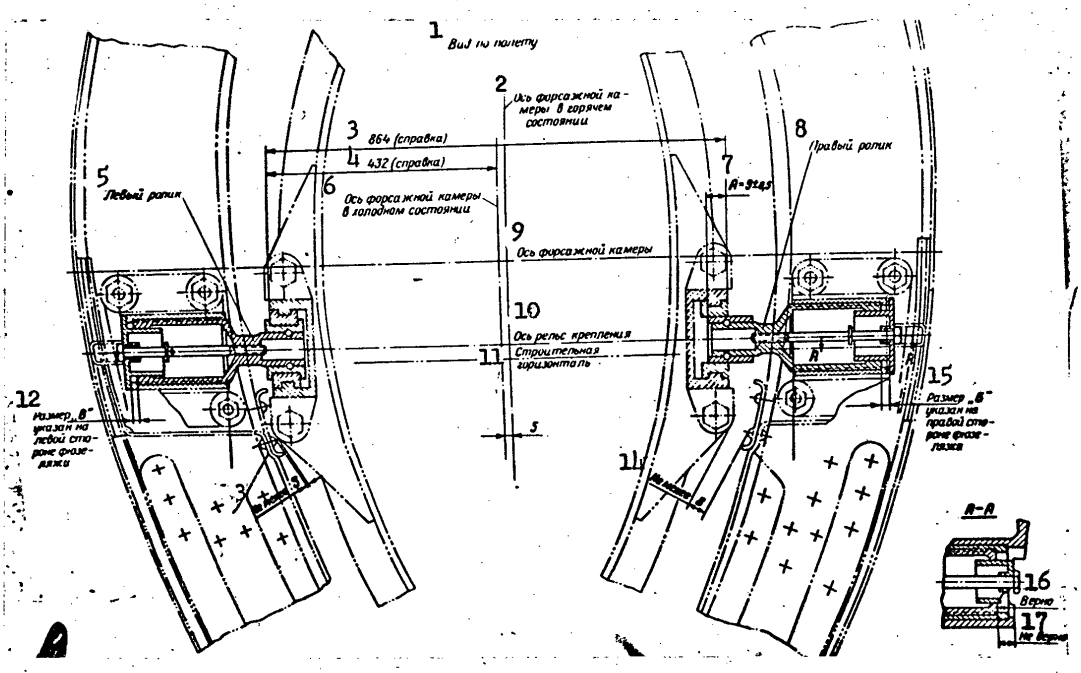


Fig. 134. Installation of afterburner chamber fastening rollers.

[p 584]

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Fig. 134. Installation of afterburner chamber fastening rollers. [p 584]

1. View toward the front
2. Afterburner chamber axis when hot
3. 864 (reference)
4. 432 (reference)
5. Left roller
6. Afterburner chamber axis when cold
7. A = 9±0.5
8. Right roller
9. Afterburner axis
10. Fastening-track axis
11. Horizontal plane
12. Dimension "V" indicated on left side of fuselage
13. 3 mm [minimum]
14. 8 mm [minimum]
15. Dimension "B" indicated on right side of fuselage
16. Correct
17. Incorrect

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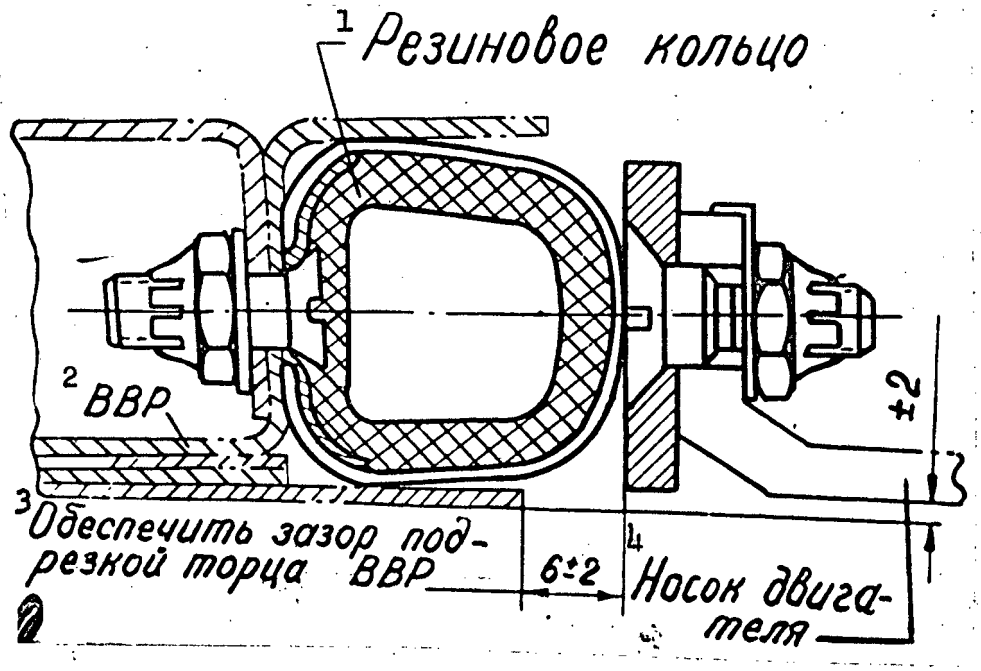


Fig. 133. Installation of the gasket section.

1. Rubber ring
2. VVR [air-air heat exchanger]
3. Provide clearance by cutting end of the VVR
4. Engine nose

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In connection with the above, after connecting the tail section, it is necessary to:

a) install the rollers for fastening the afterburner chamber at dimensions B and V according to the fuselage markings;

b) check the engagement of the right roller with the track, A = 9 (plus-minus 0.5) mm;

v) check the clearance between afterburner chamber and fuselage. On the left side of the fuselage, the clearance should be not less than 3 mm, and not less than 8 mm on the right.

7. For accurate installation of the gasket and the rubber engine-nose sealing ring it is necessary to:

a) check the alignment of the gasket and rubber ring in the groove of the air-air heat-exchanger. If the ring is out of the groove, correct it;

b) after installing the engine, check the clearance between the engine nose and the edge of the air-air heat-exchanger, which should be 6 (plus-minus 2) mm.

For convenience in engine assembly, use glue #88 on the rubber ring.

8. After installing the engine, depreserve it and flush the fuel lines in accordance with instructions for engine operation.

Before joining the oxygen-feed line to the check valve on the engine, make sure that the check valve and line are free of dirt and grease, then [p 585] connect the line to the check valve.

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On the KAF-13D afterburner control box, set the delay time for fuel and nozzle segments according to the entry in the engine logbook.

9. After completion of engine installation and fastening, inspect for leaks. Do not crimp the rim of the air-air heat-exchanger and do not allow the rubber sealing gasket to protrude.

10. When assembling the feed lines, pay attention to correct installation of the boost pump vent lines, namely:

a) the oil-line breather should be securely fastened;

b) the gasket on the end of the line must fit snugly in the cylindrical part of the nozzle on the left rear engine-bay hatch with little or no bending.

11. The clearance between the curve of the fuel filter and the rim of the air-air heat-exchanger should not be less than two millimeters.

12. After connecting the variable-area nozzle, check the freedom of its operation by deflecting it in the vertical and horizontal planes.

13. Install the variable-area nozzle on the rollers, after turning the rollers in the fuselage assemblies, with the tail section moved back 80-100 millimeters. When the tail section is moved forward, the rollers should engage in the guides without jamming. [p 586]

Install the left roller according to the fuselage marking. When installing the right roller, make sure that it extends into the guide track properly — A = 9 (plus-minus 0.5) mm (see Fig 134).

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After installing the rollers, check the clearance on the right and left between the variable-area nozzle and the inside of the fuselage, which must be at least 8 millimeters on the right and 3 millimeters on the left.

Check the axial movement of the variable-area nozzle in the engine refueling probe, which must be at least 6 millimeters.

14. Pay special attention to the sealing of the connection of the drainage system lines and the drain outlet pipes passing through the fuselage skin. To avoid getting fuel inside the fuselage, replace the packing in the breather of the refueling probe each time the engine is replaced.

5. FUEL TANK REMOVAL AND INSTALLATION

Drain fuel from tanks before removal.

After removing, carefully straighten the tank bladders and hang them in their respective tank compartments.

Before installing each bladder on the aircraft, it is necessary to sprinkle carefully the external surface of the bladder and the internal surface of the compartment with talc after having checked the fastening of the container eyelets to the fabric.

For convenience in lifting the tanks prior to installation, attach [p 587] a 0.5-meter length of KOK-1.2 wire to each eyebolt, and remove it after installing the tank.

Put BU sealant on all the lock nuts and threaded fittings and tighten.

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To remove tank No 1, it is necessary to:

1. remove the back fairing in the area of frames 11-13 and disconnect the drain lines and main pressure lines;

2. dismantle the drain pipe and float valve plate;

3. disconnect the fuel line and electrical connector from the pump and remove the pump;

4. unscrew the bolts fastening the flanges of tanks 1 and 2 through the drain plate opening and remove the two half-flanges which fasten the pipes;

5. remove tank No 1.

To remove tank No 2, it is necessary to:

1. remove the fuel line connecting the left and right hoses of tank 2 with tank 3 through the hatch between frames 14-16;

2. remove the compartment cover between frames 13-16 and disconnect the two drain pipes;

3. unscrew the three bolts fastening the refueling receptacle to the fuselage skin;

4. dismantle the intra-tank pipe through opening in the tank, left by removing the refueling receptacle, after having completed the operations in paragraphs 1, 2, and 4 for tank No 1; [p 588]

5. disconnect the fuel line through the bottom left hatch; dismantle the special valve and remove the check valve from the tank;

6. remove tank No 2.

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To remove tank No 3 (top), it is necessary to:

1. through the wheel well, remove the lines connecting the top section of the tank with the bottom section;

2. remove the compartment cover between frames 16-20; disconnect the fuel drain line and remove the drain nipple;

3. through the access hatch to the float valve, between frames 16-19, remove the emergency fuel reserve signalling device and, after disconnecting the line, remove the float valve;

4. remove the tank.

To remove tank No 3 (bottom section), it is necessary to:

1. through the wheel well, remove the lines connecting the bottom section with the top section;

2. through the bottom hatch, to the left and in front of frame 16, disconnect the line from the special valve and remove the special valve;

3. through the bottom hatch, to the right and in front of frame 16, disconnect the line connecting tank No 3 (bottom section) with tank No 2;

4. through the bottom hatch and behind frame 20, disconnect the line from the special valve and remove the valve;

5. remove the panel of the bottom hatch between frames 16-20 along [p589] with the back fairing; dismantle the SD-3 pump signalling device of the group II tanks; disconnect the electrical connector and line from the 495A pump and remove the pump; then remove the fuel transfer valve and the plate of the special valve for negative "g" forces and remove the special valve;

6. dismantle the two lines inside the tank, after having removed the couplings from the tank fittings through the wheel well;

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7. remove the check valve on frame 16;

8. remove the tank.

To remove tank No 4, it is necessary to:

1. remove the back fairing cover between frames 20-25; disconnect the drain line and remove the drain nipple;

2. open the small hatch of the refueling receptacle near frame 22 and unscrew the three bolts connecting the receptacle to the skin;

3. remove the fuel tank;

4. through the bottom hatches to the left and right between frames 20-22, remove the tank hose coupling;

5. disconnect the line from the pump of tank No 4 and remove the pump;

6. through the engine unit access hatches to the left and right between frames 22-25, disconnect the couplings joining tank No 4 with tanks No 5 and 6;

7. remove the tank.

To remove tank No 5, it is necessary to:

1. through the engine unit access hatches to the left and right [p 590] behind frame 22, disconnect the couplings joining tank No 5 with tanks No 4 and 6;

2. remove the back fairing cover between frames 22-25 and disconnect the drain lines;

3. remove the tank.

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To remove tank No 6, it is necessary to:

1. remove the back fairing cover between frames 25-28 and disconnect the fuel drain line;

2. through the bottom hatches between frames 25-28, disconnect the fuel line flanges connecting tank No 6 with tank No 5;

3. remove the tank.

Remove all tanks through their respective hatches after disconnecting all fittings.

Installation of the tanks is done in the reverse order.

6. REMOVAL AND INSTALLATION OF THE CONE

To remove the air-intake cone, it is necessary to:

1. move the cone all the way forward;

2. unscrew the fastening bolts on the circumference of the cone and remove the cone;

3. remove the antennas of the radio-electronic equipment located under the cone;

4. unscrew the fastening ring of the antennas;

5. disengage the bolt fastening the hydraulic cylinder to the slide ring;

6. remove the sliding cylinder of the cone;

7. assemble cone in reverse order.

[p 591]

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7. REMOVAL AND INSTALLATION OF LANDING GEAR STRUTS

To remove the main strut of the landing gear:

1. raise aircraft on jacks until wheels are off ground;
2. disconnect hydraulic cylinder rod from strut;
3. disconnect air hoses from strut after bleeding air from system;
4. disconnect electrical connector;
5. disconnect connecting rod of wheel axle turning mechanism from wing assembly;
6. remove fuel pump in wing for access to strut fastening bolt;
7. while supporting strut, pull out strut fastening bolt with special removing tool.

To remove nose strut of landing gear:

1. raise aircraft on jacks until wheels are off ground;
2. disconnect hydraulic cylinder rod from strut;
3. disconnect electric wiring and hydraulic and air lines after bleeding pressure from hydraulic system;
4. unscrew pivot bolt of strut support (access through hatch on right);
5. unscrew strut support bolt with special removing tool (access through hatch on left).

Install struts in reverse order. Lubricate all friction parts before installation. After struts are installed, check axial clearances between [p 592] bearings of strut support assemblies and longitudinal and lateral clearances of wheel axles.

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Adjust length of hydraulic cylinder rods and connecting rods of wheel axle turning mechanism (on main strut).

Check setting of corresponding valve and operation of strut support and flap locks. Check clearances between flaps, wheel and strut in retracted and extended positions, with strut compressed and during process of lowering.

Check operation of electric strut-position indicators.

After struts are installed, use ground pump to check retraction and extension of landing gear as well as emergency extension.

8. REMOVAL AND INSTALLATION OF BOOSTERS

To remove stabilator booster:

1. reduce pressure in hydraulic system to zero;
2. open hatches in fin for access to booster;
3. disconnect control rod leading to booster valve;
4. disconnect rod leading from booster to stabilator shaft;
5. disconnect hydraulic lines from booster connecting lines;
6. unscrew nuts from six bolts fastening booster to frame 34;
7. remove bolts and booster.

Install new booster in reverse order. When installing a new booster, maintain clearance of not less than three millimeters between rocker and edges of openings in fin girder and frame 34.

To remove aileron booster (right or left):

1. reduce pressure in hydraulic system to zero;
2. open booster access hatches on wing;
3. disconnect booster rod from aileron rocker arm;

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4. remove push rod leading to booster valve;

5. disconnect lines leading to booster;

6. unscrew nuts from four pins fastening the traverse;

7. remove booster along with traverse.

Install new booster in reverse order. When installing a new booster and connecting it with the rocker arm, no tension of booster rod is persmissible (maintain strict coaxial alignment of booster axis and rocker axis in plane of wing arc).

9. REPLACING UNITS OF STABILATOR CONTROL SYSTEM

When replacing all units, connecting rods, and rockers of stabilator control system, maintain:

a) clearance between control system assemblies and structural elements of aircraft; [p 594]

b) free rotation under own weight and gap of not more than 0.3 mm on actuating lever R = 100 mm along axis of support or fastener;

v) clearance between control system assemblies and structural elements of aircraft;

g) sufficient threads of adjusting adapter inside sleeves of push rods (check according to alignment openings in sleeves);

d) free movement of push rods at seals;

e) free installation of push rods and units without use of force.

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Replacing Push Rods

When control rods are replaced, their original length must be maintained (adjust by adapters). After rods have been replaced, check maximum stabilator deflection angles on arm of aircraft control stick.

Replacing the MP-100M Electro-Mechanism

When replacing the MP-100M electromechanism, maintain its original length in both neutral and limiting positions. After replacing the electromechanism, check its operation and the accuracy of installation of the "trim effect" mechanism by the burning of the lamp.

Replacing the Charging Mechanism

[p 595]

When replacing the charging mechanism, maintain its original length. The length of the mechanism is regulated by the connecting-rod adapter, and the exact length is set by turning the flange of the mechanism at the adapter.

After installing the charging device, check its operation by deflecting the control stick to the limiting positions and make sure of the alignment of the "trim effect" mechanism in the neutral position by the burning of the lamp.

Replacing ARU (Control Stick) Components

The entire ARU automatic unit includes:

a) the automatic (actuating) mechanism;

b) the control box; and

v) the indicator.

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In operation, the automatic (actuating) mechanism and control box comprise an integral unit. When one becomes inoperative, both must be replaced, whereas the indicator need not be replaced.

When the automatic (actuating) mechanism is replaced, the stabilator control system adjustment must be maintained.

To remove the automatic (actuating) mechanism:

1. lock control stick with special attachment and switch off the electric power supply of stabilator control system;

2. disconnect the push rod leading to the charging mechanism [p 596] from the coupling rod of the automatic (actuating) mechanism;

3. disconnect (at the automatic mechanism) the push rod extending to the rocker arm between frames 27-28;

4. disconnect charging mechanism;

5. unscrew nuts fastening the side brackets, which are fitted on pins, and remove brackets from pins together with automatic mechanism;

6. remove control box from right side of cockpit.

Install new automatic mechanism in reverse order.

NOTE: To guarantee strong connection, the length of exposed threads between the ARU-3V and the charging mechanism should not be more than 15 millimeters when the neutral position is set for the "trim effect" mechanism.

After installing automatic mechanism, check and, when necessary, adjust the stabilator control system. Also check the operation of the ARU automatic unit when adjusting for speed and altitude.

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10. REMOVAL AND INSTALLATION OF FLAPS

To remove flap (left or right):

1. remove fairing at end of track;
2. disengage flap;
3. remove bolt connecting hydraulic cylinder with flap assembly; [p 597]
4. roll flap back until carriage disengages from tracks.

Install flap in reverse order.

11. REMOVAL AND INSTALLATION OF AILERONS

To remove aileron:

1. open the wing hatch near rib 6;
2. remove bolt connecting control rod with aileron assembly;
3. remove aileron fairing for access to aileron assembly;
4. remove both assembly fastening bolts;
5. deflect aileron and remove both support bolts connecting aileron connector with wing bracket at middle of assembly;
6. lower aileron until middle assembly connector disengages from wing bracket;
7. pull aileron toward fuselage and free end support; remove aileron.

Install aileron in reverse order.

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12. REMOVAL AND INSTALLATION OF RUDDER

To remove rudder:

1. remove left fairing;

2. open hatch on right side of fin;

3. remove from bottom support all four bolts fastening flange to rocker; [p 598]

4. remove bolt on top support assembly and unscrew locking bolt;

5. turn released rudder slightly; move it back until middle support is free, and remove rudder.

Install rudder in reverse order.

13. REMOVAL AND INSTALLATION OF SPEED BRAKES

To remove front speed brake (left or right):

1. open brakes;

2. disconnect coupling rod of hydraulic cylinder;

3. pull off both brake fastening bolts;

4. remove brake.

Install brake in reverse order.

To remove third (rear) brake:

1. open brake;

2. open engine inspection hatch;

3. open lock clamp on brake, which simultaneously disconnects coupling rod of hydraulic cylinder;

4. remove both brake fastening bolts;

5. remove brake. Install brake in reverse order.

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CHAPTER XIII

[p 599]

REGULATION MAINTENANCE OF THE AIRCRAFT

1. General Conditions

1. Regulation maintenance of the aircraft and power plant is done at specific intervals depending on the number of hours of flying time or the length of storage.

2. The regulation maintenance operations after the first 10 and 25 hours of flying time are done only once and are not repeated at these intervals.

3. Regulation maintenance is carried out regularly after every 50 and 100 hours of flying time and after every 10 days, 30 days, and 3 months, regardless of flying time.

When the 100-hour maintenace is being done, the 50-hour maintenance must be done at the same time, and when the 3-months maintenance is being done, the 10- and 30-day regulation maintenances are done at the same time; when the 30-day maintenace is being done, the 10-day maintenance is also done.

4. If for any reason the aircraft is not flown for a period of more than 30 days, it must be inhibited in accordance with instructions for inhibiting the aircraft for a period of three months.

Do not perform any regulation maintenance work on an inhibited aircraft during the time it is in storage.

Upon expiration of the 3-month storage period, the aircraft must be re-inhibited after all regulation maintenance procedures have been carried out.

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5. During an extended interruption of flight of an aircraft which is not inhibited, regulation maintenance for storage must be done every 10 and 30 days. [p 600]

6. Nonroutine regulation maintenance is permitted when:

a) the aircraft is being prepared for extended continuous operation, during which no possibility of regulation maintenance is anticipated;

b) it is necessary to advance the time for regulation maintenance of the aircraft to comply with regulation maintenance of the engine;

v) climatic conditions are unfavorable (excessive humidity and dust);

7. Before beginning regulation maintenance, unload the canopy- and belly-tank jettisoning actuators.

8. During inspections and regulation maintenance, the external surfaces of the aircraft must be cleaned of dirt and old grease.

The general lubricant for the aircraft is TsIATIM-201, with the exception of the parts and units listed below, which are lubricated as follows:

engine and aircraft hinge connections with TsIATIM-221;

wheel bearings with NK-50;

turbo-cooler bearings with OKB-122-14;

cables in flexible armor with MK-8 oil or transformer oil;

ARU-3V rod with OKB-122-7;

threaded portion of screws for fastening parts of fuselage in high temperature zones with USSA graphite lubricant.

9. Regulation maintenance on engine is done according to operating instructions.

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After First 8-12 Hours of Flight

Fuel System

1. Remove and wash filter of main pressure line installed under tank No 3.

Hydraulic System

[p 601]

2. Replace the fine-filtering elements of the following filters:

FG-11-100-2 at NP-34-2T pump outlet of main hydraulic system;

FG-11-100-2 at tank intake of main hydraulic system drain line;

11GF4-1 at tank intake of by-pass line from NP-34-2T pump of main hydraulic system;

11GF4-1 at BU-51MS intake from pressure lines of main hydraulic system.

Wash coarse filtering elements with pure gasoline and check their fastening.

After First 20-30 Hours of Flight

Hydraulic System

3. Change AMG-10 oil in main hydraulic system and hydraulic booster system without removing and washing tank.

4. After draining oil, wash choke in front of pressure-relief [anti-stall] valve.

5. Remove, wash, and inspect screen filter on left side of fuselage in drain line of hydraulic booster system in front of hydraulic tank intake.

6. Replace fine-filtering elements in following filters:

FG-11-100-2 at NP-34-2T pump outlet of main hydraulic system;

FG-11-110-2 at tank intake of main hydraulic system drain line;

11GF4-1 at tank intake on by-pass line from NP-34-2T pump of main hydraulic system;

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11GF-4-1 at BU-51MS intake from pressure lines of main [p 602] hydraulic system;

FG-11-100-2 at NP-34-2T pump outlet of hydraulic booster system;

11GF-4-1 at BU-51MS intake from pressure lines of hydraulic booster system.

Wash coarse filtering elements in clean gasoline and check their fastening.

If metallic particles are found in filtering elements, check the intake filters of the hydraulic boosters; if these intake filters contain metallic particles or splinters, replace the boosters.

NOTE: Fine-filtering elements of the main hydraulic system are replaced twice during the first 25 hours of flying time: once after first 10 hours and once again after an additional 15 hours of flying time. Thereafter, fine-filtering elements in the main hydraulic system are replaced after every 25 hours of flying time, and after every 50 hours of flying time in the booster system. Since there is no regulation-maintenance record sheet for the 25-hour period, a separate record of filter condition and replacement must be kept for this period.

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5. After Every 50 (45-55) and 100 (90-110) Hours Flying Time

[p 603]

No.	Work Performed	50 hrs	100 hrs
	Fuselage		
7.	Disconnect fuselage tail section and inspect condition of inside skin. Be sure there are no deformations, warping, burns, cracks or soot on inside surface of skin in tail section, engine housing, nor on shield of drag chute well. Inspect components, fuel lines, and drain lines of all systems located in engine bay, in area of frame 28, and in fuselage tail section. Open hatch inside fuselage tail section and check condition of lines, electric wiring, and security of their fastening.	+	+
8.	Manually test ease of turning of fastening rollers for extension tubes on both sides of fuselage. If rollers do not turn, remove them, wash them in gasoline and inspect them; if there are signs of wear, replace rollers.	+	+
9.	Examine condition of rubber seal on frame 28; check working order of cover locks of fuselage service hatches.	+	+
10.	If engine is removed from aircraft, check: condition of rubber pressure seal and sealing of engine nose with air intake duct and make sure there is no buckling or drawing-in of individual parts; condition of VVR (air-air heat-exchanger) louver fins; louver edges, which regulate air flow, should be bent 8 millimeters from surface of heat-exchanger rim.	—	+
11.	Remove top fairing and check condition and connection of tubing and condition of components.	+	+
12.	Open pressure relief valves and examine push rods, mounting assemblies, hinge connections and safetying of nuts.	+	+
13.	After closing fuselage, check operation of parabrake system.	+	[p 604] +
14.	Pour 55 grams OKB-122-14 oil through special openings into turbo-cooler housing to lubricate bearings. NOTE: When assembling fuselage parts in high-temperature zones, cover threaded portion of fastening screws of tail section, parabrake shield, and engine cooling jacket with USSA graphite lubricant.	+	+

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1	2	3	4
	Wing		
15.	Remove wing fairings; wash, inspect and lubricate wing-fuselage joints. Check condition of fairing fastening screws. In wing joints, check condition and fastening of tubing and electrical cables for contact, abrasion, and weak connections.	—	+
16.	Open wing hatches and wash, inspect and lubricate aileron suspension assemblies.	+	+
17.	Remove ailerons and examine main ribs for cracks. Wash, examine, and lubricate suspension assemblies. Make sure that bearings turn easily and there are no broken rings or races. Check safetying of aileron counter-weight bolts. Lubricate suspension assemblies and install ailerons on wing.	—	+
18.	Remove and inspect flaps. Wash and lubricate mechanisms and pay particular attention to condition of bearings and races. Install flaps and check their adjustment.	—	+
	Controls		
19.	When wing and fuselage hatches are open and fairing is removed, wash, examine and lubricate open-type hinge joints in aircraft controls (use TsIATIM-221 lubricant). (Wipe clean and grease outside of closed-type ball-bearing hinge joints with thin layer of TsIATIM-221.) Check clearance between rollers of supports and ends of push rods (should be 0.05 - 0.3 mm); if necessary, adjust clearance by turning square-head cam bolt on support. Check to see that control parts are not in contact with structural elements, and that control parts are not corroded.	+	+ [p 605]
20.	Check fastening of stabilator and rudder counterbalances.	+	+
21.	With control stick and pedals locked, check for backlash followed by clatter in rudder and aileron controls.	+	+
22.	Remove pedals and examine pedal-strap fastening locks; make sure that clips and cotter pins are secure and that each lock can be opened easily with one hand.	—	+
23.	Lubricate (with TsIATIM-201) internal bearings of stabilator shafts.	+	+

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1	2	3	4
24.	Lubricate (with TsIATIM-221) those surfaces of stabilator and rudder control-rods which pass through cockpit seals. Through bottom fuselage hatch between frames 11 and 13, lubricate ends of aileron and engine control rods which pass through cockpit seals. While moving aircraft control stick, pedals and RUD (throttle), work lubricant into respective cockpit seals.	+	+
	Landing Gear		
25.	Wash landing gear struts with gasoline and examine them with a magnifying glass, with particular attention to welded seams and places where strut axle bushing and bushing of hydraulic cylinder bolt meet at the cylindrical part of the strut.	+	+
26.	With aircraft raised on jacks, check play in struts, measured at wheel axles in longitudinal and transverse directions. (When aircraft is on jacks, nose wheel must be aligned in direction of flight.) When a force of 15 kg is exerted uniformly, forward and backward, the total play must be: a) not more than 8 mm in either direction for main landing gear strut, and b) not more than 5 mm in either direction for nose strut.	+	+ [p 606]
27.	Check level of AMG-10 oil in strut shock absorbers and fill if necessary. NOTE: Shock absorber oil should be changed every 3 years.	+	+
28.	Check operation of automatic wheel-brake releasing [anti-skid] system as prescribed in chapter, "Landing and Take-Off Devices."	+	+
29.	Check maximum pressure in main wheel brakes and operation of UP-24 pressure-relief booster and emergency valve 563600. To do this, disconnect brake pressure hoses, one at a time, from wheels, install manometer and, while alternately pressing on brake lever and opening emergency brake valve, make sure that maximum air pressure in the main brake system is 15.5 - 16.5 kg/cm^2 and 12-20 kg/cm^2 in the emergency brake system. Reconnect lines to wheels and check seals.	+	+

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1	2	3	4
30.	Check maximum air pressure supplied to nose wheel (should be 10-11 kg/cm^2).	+	+
31.	Remove, clean, examine and lubricate (with TsIATIM-201) traverse bolts of main struts and nose strut. Once in position, bolts are tightened with standard wrench.	+	+
32.	Remove, clean, examine and lubricate (with TsIATIM-201) bolts and shafts of hinged-connected rods in main wheel turning mechanisms and of actuators of hinged-panel locks, and hinged supports of these panels.	+	+ [p 607]
33.	Use gage to measure clearance between support on frame 6 and top lever arm of nose strut. Clearance must not be greater than 0.45 mm when force of 15-20 kg is applied to strut axles in direction of flight (landing gear valve in neutral position).	+	+
34.	Check condition of wire cables from main landing gear struts to wheel door locks. Using rag moistened with kerosene, clean corroded parts of cable, wipe dry and lubricate with TsIATIM-201.	+	+
35.	Check mechanical lock-opening cable of independent nose strut release and cable sealing boot.	+	+
36.	Check oil level (AMG-10) of nose strut vibrashock and, if necessary, fill compensating chamber.	+	+
37.	Change oil in vibrashock.	—	+
38.	Test retraction and extension of landing gear. At same time, check: a) response of valves during retraction and extension of landing gear; b) clearances between strut panels and fuselage and wing skins (see clearance diagrams in chapter, "Landing and Take-Off Devices"); c) independent nose strut extension; d) emergency landing gear extension; e) accuracy of fitting of all three struts to locks in up and down positions, and fitting of doors into locks in up position; f) operation of signalling devices in up and down positions, and adjustment of limit switches as described in chapter, "Landing and Take-Off Devices;" g) automatic braking of wheels during retraction;	+	+ [p 608]

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1	2	3	4
	h) adjustment of locks of main strut semi-axles and alignment of gage apertures and clearance between semi-axle mount and shock absorber header (clearance must be 0.03 - 0.25 mm); aperture alignment and clearance checked only when aircraft is on jacks. NOTE: 1. After an emergency extension of landing gear, check closing of mechanical locks of gear retracting struts by bleeding air from them and applying a force of approximately 50 kg to each wheel in the direction of extension and retraction. If strut locks are in good working order, struts should not move. 2. After an emergency extension, and after making sure that all air is removed from hydraulic system, raise and lower landing gear 8-10 times. 3. After extending nose strut by independent system, check position of nose strut mounting lock which should be closed. If lock is open, close it by pulling back handle of independent nose-strut release.		
	Cockpit		
39.	Check condition of canopy for damage to protective shield and for corrosion, especially of magnesium-alloy parts.	+	+
40.	Check windshield for nicks, scratches, or crazing. Remove shallow scratches and nicks according to recommendations in chapter,"Cockpit Canopy."	+	+
41.	Wash with gasoline and lubricate (with TsIATIM-201) the mechanisms in inside and outside manual canopy release levers and canopy-to-fuselage locks (without dismantling locks).	+	+
			[p 609]
42.	Check de-icing sprayer and, if necessary, clean openings with soft wire (after removing baffle plate).	+	+
43.	Remove and wash hot water tank of de-icing system. Replace tank.	—	+
44.	Check sealing of canopy de-icing system under operating pressure of 3 kg/cm^2. Before checking, disconnect system from dispenser and plug disconnected ends.	+	+
45.	Check tightness of nuts connecting lines of cockpit blower.	—	+

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1	2	3	4
	Hydraulic System		
46.	Replace fine filtering elements in all filters of booster system and main hydraulic system. At same time, wash coarse-filtering elements and check their fastenings. REMINDER: Fine-filtering elements in main hydraulic system are replaced every 25 hours of flying time.	+	+
47.	Remove, wash, and examine screen filter on left side of fuselage in drain line of hydraulic booster system in front of hydraulic tank intake. (Before removing filter, drain AMG-10 oil from booster section of hydraulic tank through intake nipple of hydraulic ground-pump connector.	+	+
48.	Remove, wash, and examine choke in front of pressure relief valves.	+	+
49.	Remove pressurizing unit of hydraulic system installed in wheel well of left landing gear; press thrust release ring and remove air filter from bottle. Wash and dry filter and drain condensate from bottle.	+	+
50.	After closing fusleage and completing all work on hydraulic system, check internal and external seals of main hydraulic and booster systems and operation NP-27T emergency pumping station and NP-34-2T hydraulic pumps.	+	+ [p 610]
51.	Check sealing of hydraulic tank pressure lines (check sealing of fuel system at same time).	+	+
52.	Check internal sealing of cylindrical hydraulic accumulators. NOTE: A thorough washing of both hydraulic systems, with hydraulic tank removed and AMG-10 oil changed, is done every 200 flying hours but not more than once every 2 years. Procedures for washing and changing oil and for operations 50-52 above are given in chapter, "Maintenance of Aircraft Hydraulic System."	-	+
	Hydraulic Boosters		
53.	Remove, examine, and wash screen filters in hydraulic booster inlet connections in clean gasoline. If metallic particles or splinters are found in filter, send booster to maintenance shop for dismantling and checking.	+	+
54.	When hatches of hydraulic boosters of BU-45A ailerons and BU-51MS stabilator are open, check for leakage of fluid	+	+

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1	2	3	4
	through outer seals. With hydraulic booster system at normal operating pressures, check for leaks in outer booster seals by deflecting the control stick. If hydraulic booster is not used for an extended period, increased leaking of seals can result which may correct itself upon operation at normal operating pressures.		
55.	Check fastening of hydraulic booster, reliability of its connection to push rods and lines, and also security of the locking wires. Lubricate BU-51MS hydraulic booster with TsIATIM-201 grease at the grease fittings. NOTE: After completing work on hydraulic boosters and booster system, test aircraft control with boosters switched on.	+	+
	Pneumatic System		[p 611]
56.	Remove, wash, dry, inspect, and install air filters.	+	+
57.	Check sealing of check valve of canopy jettisoning system behind seat (for procedure, see chapter, "Cockpit Canopy").	+	+
58.	Remove emergency air bottle from canopy jettisoning system. Examine it and its fasteners and drain condensate. Replace bottle and use special attachment to fill bottle with air up to pressure of 110-130 kg/cm^2 and, without filling main air system, check sealing of jettisoning system by pressure gage on attachment.	-	+
59.	Check, by sections, sealing of air system and operation (closing) of air valve in system for cooling pressurized fuselage compartment. Work procedure is given in chapter, "Air System."	+	+
	Fire-Fighting Equipment		
60.	Check condition and fastening of components and lines of fire-fighting equipment. If engine is removed, check sprayer openings. Together with electrical equipment specialists, check extinguisher bottle cartridge and insulation resistance. Also check "fire" warning-light circuit.	+	+
	Fuel System		
61.	Remove filter from special valve in main pressure line.	+	+

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1	2	3	4
	Examine and wash it.		
62.	Remove, examine, and wash (in clean gasoline) strainer in wing tank fuel line (see Fig. 15).	+	+
63.	Unscrew drain plug from drop tank. Wash screen filter and check for dirt around opening near plug at bottom of tank.	+	+
			[p 612]
64.	Remove negative-"g" valve from bottom section of tank 3; Examine parts, connections, and safetying wires; and check operation of valve mechanism. Examine inner surface of tank through compartment hatch and clean sides and bottom.	-	+
65.	Remove top half of fuel tank 3 and the float-valve plates and floats of tank 1. Check for traces of corrosion and damage. In the depressed position, the valve floats should, by the force of their springs, seat tightly on the calibrated openings.	-	+
66.	Drain residue and unused fuel from wing compartments through drain plug at bottom of each wing by alternately jacking each wing 200 mm.	-	+
67.	Check fastening of all fuselage fuel tanks and safetying of locking wires.	-	+
68.	Check condition of bottom half of main fuel tank through left fuselage hatch. If cracks or exposed fabric are observed on outer rubber coating, install a new tank.	+	+
69.	Remove fuel pressurization system unit from wheel well of right landing gear. Press thrust release ring and unscrew air filter from bottle. Wash and dry filter and drain condensate from bottle.	+	+
70.	Remove, wash and examine fuel pressurization system filter between tank and PNR10-9M pump.	+	+
71.	Check sealing of fuel system and fuel pressurization system as indicated in chapter, "Fuel System."	+	+
	Power Plant		[p 613]
72.	Move cone by hand to extreme forward position and remove it	+	+

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1	2	3	4
	from aircraft. Check working order of cone limit switches, clean cone control mechanism and check for wearing, scratches, etc., after which lubricate mechanisms with thin coating of TsIATIM-201 grease and replace on aircraft. Together with aviation equipment specialists, check efficiency of cone, pressure relief valves, and interlocking of RUD according to mach number.		
73.	Check engine control in cockpit and in engine bay. Check for wear of control rods and play in control system. Check connection tightness and safetying of locking wires. In engine bay, check presence and completeness of safety wires fastening lever of NR-21F component and lever of the PURT-1F panel. Lubricate hinge connections with TsIATIM-221 grease.	+	+
74.	Check smoothness of movement of engine throttle lever and its proper locking in all positions.	+	+
75.	With engine inoperative, check conformity of cockpit throttle positions to position of levers on NR-21F system and PURT-1F on engine (in accordance with instructions for engine operation).	+	+
76.	Examine visible engine fastening assemblies.	+	+
77.	Check nuts of engine fuel-line connections and tighten if necessary.	+	+
78.	After completing 50-hour regulation maintenance and assembling fuselage, check, with engine operating; a) external sealing of fuel, oil, and hydraulic systems of aircraft and engine; b) emergency nozzle-segment control system, performance of instrumentation generator hydraulic control, aircraft control and cockpit power supply.	+	+ [p 614]
79.	If engine has exceeded manimum permissible hours of operation, replace it with a new one. Prior to installation of engine: a) check engine mounting assemblies: b) wash and lubricate open-type hinge connections of engine controls with TsIATIM-221 grease. WARNING: When installing new engine, do not change the adjustment of the engine fastening rod.	-	+

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6. MAINTENANCE PERFORMED ON PARKED AIRCRAFT

No.	Type of maintenance performed	Maintenance performed every		
		7+3 days	30+5 days	3 Mon + 10 days
	Wing			
1.	Lower flaps, wash, examine and lubricate guide tracks. Check fastening of hydraulic cylinder and safety-of fastening nuts. Make sure guide rollers do not bind. Check for leakage of flap cylinders.	-	-	+
2.	Make sure that safety wire of horizontal wing-fuselage fastening near frame 28 is in good condition as well as fastening of flap tracks to fuselage.	-	-	+
				[p 615]
	Control			
3.	Check operation of control stick (ARU) when adjusting for velocity and altitude and also check full movement of stick from one extreme position to the other. Oil ARU-3V rod with thin coating of OKB-122-7 grease (aviation equipment specialists and aircraft specialists perform the check). Lubricate rod of stabilator control actuator with TsIATIM-201 grease.	-	-	+
4.	Lubricate outer stabilator shaft bearings with TsIATIM-201 grease. Wash, examine, and lubricate rudder mounting assemblies.	-	-	+
	Landing Gear			
5.	Check play in nose strut doors which, when measured at ends of doors, should not exceed 7 mm when a force of 2-3 kg is applied to end of door.	-	-	+
6.	Check play of main gear wheel doors which, when measured at end of door, should not exceed 12 mm when a force of 2-3 kg is applied with strut extended. (No play is permissible on doors rigidly fastened to strut).	-	-	+
7.	Lubricate fittings of landing gear strut hinges with TsIATIM-201 grease.	+	+	+
8.	Remove wheels of main and nose struts and check con-	-	-	+

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1	2	3	4	5
	ition of braking devices. Remove, examine and lubricate wheel bearings with NK-50 grease. (Procedure for checking brakes given in chapter on "Landing and Take-Off Devices"). NOTE: Condition of braking devices also checked each time wheels are replaced.			
9.	Alternately disconnect hoses from each wheel and carefully press brake lever on aircraft control stick to blow out wheel brake lines. Then, after releasing lever, open emergency brake valve. Reconnect lines and check sealing.	-	-	+
10.	Check tire pressure with gage.	-	-	+ [p 616]
11.	Raise aircraft on jacks and check nitrogen pressure in shock absorbers with gage.	-	-	+
12.	Wash and lubricate parts of kinematic (two-part) lock holding the semi-axle and, with aircraft on jacks and landing gear down, check its operation by inserting 3-mm diameter probe-rod into check aperture of kinematic lock assembly. With lock fully closed, probe should pass freely through aperture to depth not less than 22 mm. If apertures do not coincide (probe will not pass through), adjust lock by using insert to change length of connecting rod of semi-axle turning mechanism.	-	-	+
13.	Check retraction and extension landing gear. At same time check: - retraction and extension of main landing gear and operation of corresponding valves; - independent extension of nose gear; - locking of all three struts in up and down position and locking of doors in up position; - operation of signalling devices; - automatic braking of wheels during landing gear retraction.	-	-	+
	Cockpit			
14.	After removing switch panel on left side of cockpit, check firmness of gear wheel retaining screw on canopy control valve.	-	-	+
15.	Check condition of flexible control cover and control cable of PU-7 valve and fastening of PU-3 valve, levers	-	-	+

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1	2	3	4	5
	and push rods controlling them. Wash hinges in gasoline and examine. Lubricate hinges and rod of PU-7 valve.			[p 617]
16.	Check canopy for scratches and nickes on windshield, defects of the protective covering, and leaks in the windshield seals.	-	-	-
17.	Examine cockpit sealing hose for cracks, worn spots, and damage to light- and ozone-resistant covering.	-	-	+
18.	Visually check operation of distributor valve (unit 525) through bottom left fuselage hatch. Complete switching of distributor valve should not take more than 30 seconds.	-	-	+
19.	Check cockpit pressurization (check procedure given in chapter, "Pressurized Cockpit," items 18 and 19).	-	-	+
	Hydraulic System			
20.	Check cleanliness of sediment tank drain opening in front of hydraulic tank pressurizing unit.	+	+	+
21.	Check nitrogen pressure in spherical hydraulic accumulators with gage attachment. Pressure should be 50-55 kg/cm^2 (at zero pressure in hydraulic system).	-	-	+
22.	Check degree of pressurization in engine hydraulic system while engine is running; this is done by installing (before starting engine) gage attachment in place of hydraulic tank filler cap (in booster system housing). At 70-80% maximum rpm, excess pressure should be 1.6-2.55 kg/cm^2 (this test done at same time as fuel system pressure test).	-	-	+
23.	With APA-2M turned on and with pressure in booster system, check efficiency of emergency NP-27T pumps at capacity indicated in chapter, "Servicing Aircraft Hydraulic System."	-	+	+
	Fire-Fighting Equipment			[p 618]
24.	Together with electrical equipment specialists, check "fire" warning circuit.	+	+	+

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1	2	3	4	5
	Fuel System			
25.	With engine operating, check pressurization of fuel systems (simultaneously check pressurization of hydraulic tank). Pressurization check is given in chapter, "Fuel System."	-	-	+
26.	Check cleanliness of drain openings and sedimentation tank in front of fuel tank pressurization unit.	+	+	+
	Power Plant			
27.	Together with aviation equipment specialists, check operational efficiency of cone, pressure relief valves and engine throttle locking according to mach number. Check procedure is given in chapter, "Power Plant Control."	-	-	+

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WORK TO BE DONE EVERY 12 MONTHS

Canopy

Preventative maintenance of canopy, in addition to that indicated in section, "The Cockpit," is done once a year along with preventative maintenance of seat.

1. Check operation of diaphram valve, jettisoning mechanism, and TSM-2500-38 initiator bleed valve.

2. Remove hinged section of canopy from aircraft and place it on special stand.

Check operation of canopy emergency lock-opening system.

3. Install canopy hinged section and test canopy opening and closing. [p 619]

NOTE: Carry out all operations in strict conformance and sequence as indicated in chapter VIII, "The Cockpit Canopy." After completion of maintenance and testing, make sure that all locks are fully closed and moving parts safetyed.

The Seat

Preventative maintenance of the seat is done in order to check the operation of those mechanisms which are triggered upon ejection, to check the working condition of the seat parts, and to replace old grease.

Remove seat from aircraft, place it on special pyramid stand, and carry out following operations:

4. Check piercing of primer caps by triggering firing mechanism control system.

5. Check opening of pilot's seat locks by operating emergency handle.

6. Check operation of hinge supports under canopy and force required to close them.

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7. Check set screws and their security in seat assemblies.

8. Examine magnesium alloy seat parts (bucket, footrests, transverse girders) for corrosion.

Remove dust and old grease from parts and mechanisms.

9. Examine and clean all cable wires, check them for broken strands, [p 620] and if necessary, lubricate with TsIATIM-201.

10. Lubricate all friction connections with TsIATIM-201.

11. Remove jack screw housing of seat-height adjusting mechanism and grease screw with TsIATIM-201.

12. Lubricate seat bucket guide tracks.

13. Change grease in gear housing of MU-100AP motor. Remove plug in bottom of housing, wash gear compartment with gasoline and refill with TsIATIM-201 grease.

14. Check insulation of electrical wiring and working order of MU-100AP motor power supply connectors.

15. Remove stabilizing parachute. Test and pack it according to instructions.

16. Put new cartridges in firing mechanisms.

Install seat and TSM-2500-38 initiator in aircraft and perform required readiness operations.

NOTE: 1. Clean firing mechanisms in accordance with manufacturer's instructions.

2. Maintenance procedures for the seat are given in the respective sections of the chapter, "The Ejection Seat."

3. When conducting preventative maintenance on the 215P parachute initiator, replace the lock fastening plates of

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the tri-linked yoke with new ones, i.e., these plates are used only once.

The Cockpit [p 621

With the seat removed:

17. Check insulation on "hot" line of cockpit blower system. If necessary, restore insulation. Tighten nuts and check safetying wires.

18. Wash and lubricate surface of engine throttle rods passing through seal inside of cockpit with TsIATIM-221 grease.

Deflect throttle control to lubricate cockpit seals.

19. With protective jacket removed and sealing boot unlaced, wash and lubricate aileron control rods which pass through seal in side of cockpit.

Allow grease towork into cockpit seals by deflecting aircraft control stick left and right.

20. After removing cockpit floor, check clearances between control rods and adjacent fuselage elements over entire range of deflection of aileron, stabilator, rudder, and engine control systems.

Minimum allowable clearance is 4 mm. Bent aircraft and engine control rods should be replaced with new ones.

NOTE: During all work in cockpit with seat removed, a safety protective pad, available in 184 ground-equipment kit, must be installed before any work is done in cockpit.

TECHNICAL SERVICING OF IDLE AIRCRAFT AND ENGINE [p 622

If for any reason the aircraft is grounded and is not inhibited, carry out the work listed below:

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Every 8-12 Days

1. Pre-flight the aircraft.

2. With hatches and plugs removed from air-intake and variable area nozzle, examine external parts of engine for corrosion.

Treat corroded areas in accordance with instructions for the engine.

3. Start engine and check all its operations according to the charts.

4. With engine operating, check performance of instruments and sections of special equipment and aircraft control system.

At normal booster operating pressure, make 8-10 full deflections of control stick forward and backward, left and right, and diagonally and at the same time, make sure that the hydraulic booster is operating normally.

5. When pre-flighting aircraft after storage, test retraction and extension of landing gear, flaps, and speed brakes and check operation of movable cone and pressure relief valves.

[p 623]

6. If aircraft is not to be pre-flighted, change grease on strut rods, hydraulic cylinders, boosters and ARU-3V booster control lever.

Every 30 Days

7. Repeat operations done every 8-12 days.

8. Wash and lubricate surfaces of stabilator, rudder, and aileron control rods which pass through cockpit seals.

Work grease into seals by moving control stick and pedals.

9. When pre-flighting aircraft, check cockpit pressurization.

10. Check hydraulic accumulator and landing-gear shock-absorber charging and tire pressure.

11. Drain fuel sediment from drain points and have it analyzed.

12. Inspect electronic equipment.

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WARNING: During the course of aircraft down-time, the engine fuel system must be filled (to prevent corrosion of fuel components).

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APPENDICES

AIRCRAFT PROTECTION [p 624

If the aircraft is grounded for a period of more than 30 days, and also before packing it for transport, it is necessary to inhibit the aircraft.

Prior to inhibition, remove dust, dirt, moisture and old grease from surfaces by rubbing with a clean cloth moistened with unleaded gasoline and then wipe units and parts dry with a clean cheese cloth.

Use TsIATIM-201 grease and technical vaseline as a preservant. Do not grease parts protected with paint.

1. Grease all aircraft mechanisms, ball bearings of disconnected rods and rocker arms, and cables.

2. If transporting the aircraft, grease all unpainted parts and assemblies with technical vaseline preheated to 60-80°C.

3. Lubricate wheel bearings with NK-50 grease.

4. Cover parts and assemblies with a thin even layer of grease using a soft hair brush.

5. Rub rubber parts, pressurizing hose, hydraulic hoses, fuel and air systems hoses, hatch frame gaskets, etc., with talc.

6. If paint on parts is damaged, repaint. [p 625]

7. Wrap ball bearings of disconnected rods (if aircraft is to be shipped) in double layer of wax paper, then in cloth, and tie with binder twine.

8. Plug all open ends of lines with rubber caps or corks (stoppers) and seal them.

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9. Cover all fuselage and wing openings of dismantled aircraft with heavy cloth or other material (to prevent internal contamination).

10. When inhibiting aircraft, DO NOT grease the fittings of the oxygen system.

11. The hydraulic and fuel systems must be completely full. (Do not fill if shipping).

12. Cover canopy with a soft cloth.

13. Cover and seal intake duct and exhaust nozzle.

14. Mothball individual parts according to manufacture's instructions.

15. After completing above procedures, cover aircraft.

16. When de-preserving the aircraft, carry out regulation maintenance for the particular period of storage. Do not do any maintenance of aircraft during storage. Inhibition period is 3 months.

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Appendix 2

MAINTENANCE OF MAGNESIUM ALLOY PARTS [p 626]

There are parts and components in the aircraft structure made of magnesium alloys. These are less stable to corrosion than parts made from other materials and require careful and continued maintenance.

Corrosion of these parts can take place under the following conditions:

- rupture of protective covering;
- condensation of moisture from lack of ventilation or temperature fluctuations during 24-hour period;
- water falling on parts;
- action of salt water, acids, alkalis, or corrosive gases.

Corrosion of magnesium alloys develops at those points where paint blisters and moisture condenses.

When examining the aircraft, check for corrosion of magnesium alloy parts, especially under ends of bonding jumpers.

For easy recognition, all magnesium alloy parts are painted blue, except landing-gear wheel parts (green), control pedals (black), and instruments (gray).

Whenever magnesium alloys parts come in contact with salt water, salt [p 627] solutions, acids, alkalis, or fire-extinguisher foam, these areas must be washed thoroughly with warm water, dried, and washed with clean gasoline.

Corroded parts are cleaned and repainted on the aircraft or after removal (depending on ease of access or degree of corrosion).

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Parts with blistered paint and corrosion sites only slightly affecting the surface of the part, are cleaned in the following manner:

a) Carefully clean corroded area with #180 or #200 sandpaper and if there are corrosion pits, scrape them until all traces of corrosion are removed.

b) Scour corroded area with clean, unleaded gasoline;

c) Apply coating of 10% solution of selenous acid to cleaned area and wipe dry.

d) Apply coating of ALG-1 primer and dry at 25-35°C for at least 24 hours and then at 12-17°C for at least 36 hours.

If rapid-drying ALG-10 primer is used, surface will dry in 3-4 hours at 18-35°C.

e) If corroded areas are on internal parts of aircraft, apply coat [p 628] of A-9 or A-9F enamel over primer coat; if areas are on landing wheels, apply coat of A-24G enamel. Dry these parts at 18-35°C for 24 hours and then at 12-16°C for 36 hours (at lower temperatures, drying time is longer).

f) If, in the course of drying, a part becomes contaminated, wipe the section with a clean cloth moistened with unleaded gasoline before applying the next coat.

g) No moisture should come in contact with part during this work.

Replace parts which are extensively corroded and have a considerable number of deep corrosion pits on their surfaces, as well as parts with isolated deep pits.

Parts with pitted bearing surfaces should also be replaced.

Do not join chromium-, silver-, or copper-plated parts to magnesium alloy parts. Steel, bronze, or brass parts, joined with magnesium alloy parts, must be galvanized or cadmium plated and aluminum alloy parts must

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be anodized. Ball bearings may be used without galvanized races, but must be coated with TsIATIM-201 grease. Coat cleaned and uncovered areas of magnesium alloy bonding jumpers with ALG-1 primer coating.

WARNING: Selenous acid vapors are noxious. When using this solution, do not allow it to come in contact with unprotected skin and clothing. [p 629]

NOTE: If no commercial selenous acid solution is available, it can be prepared in the following manner: add 20 grams selenous acid and 10 grams sodium dichrmoate to 1 liter water.

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Appendix 3

MAINTENANCE WORK ON OUTER SURFACE OF AIRCRAFT [p 630]

Coatings of paint are used to protect metal parts from corrosion and to improve the aerodynamic properties of the aircraft.

The protective properties of the paint coatings are reduced by the effect of fuels, oils, acids and alkalis as well as by mechanical defects.

When servicing the aircraft, it is necessary to remember that when the specifications given below are not observed, the protective properties of the paint are prematurely reduced, and their period of service is shortened.

The aircraft parts most subject to corrosion are:

- bottom surfaces of wing, fuselage, and stabilator;
- surfaces near exhaust nozzle;
- skin sections near aircraft batteries.

Corrosion of aircraft skin occurs most frequently when there are long intervals between flights.

To protect the outer surfaces from mechanical damage, effect of sun rays and precipitation, it is necessary to observe the following: [p 631]

1. Use cleaned cloth or rubber mats when working on the outer aircraft surfaces.

2. Do not place parts, tools, or rags soaked in oil, kerosene, etc. on the aircraft skin.

3. Use only cloth- or rubber-covered stepladders and scaffolds.

4. In order to avoid damage to the paint and oxide films, do not walk on aircraft skin with coarse or dirty footwear.

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5. If aircraft are parked out in the open, cover them regardless of the time of year.

6. Do not cover aircraft with dirty or damp covers.

7. Keep aircraft covers clean and check them regularly for defects. No defective covers are to be used.

8. If moisture condenses on the aircraft skin under the covers, remove the covers, wipe the metal surface dry with cloths, dry the covers and replace them on the aircraft.

9. Do not spill acids or alkalis on the aircraft skin. It is therefore necessary to take precautionary measures when installing and removing the aircraft batteries. All battery servicing is to be done outside the aircraft.

[p 632]

If acids come in contact with the skin or other parts of the aircraft, quickly wash the affected area several times with warm water and dry with a clean cloth.

In areas where spilled acid can be trapped (slots, along seams), washing must be done with special care and the area subsequently blown with compressed air.

When acid is washed off, record this instance in the aircraft log and check the condition of this surface regularly for three months. If parts become corroded as a result of having acid spilled on them, immediately notify the section engineer.

10. If oil falls on the aircraft skin, quickly wipe it up with a clean cloth soaked in unleaded gasoline.

11. When corrosion sites are found on the skin:

a) wipe with clean cloth soaked in unleaded gasoline;

b) clean with hair or bristle brushes and, if corrosion

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products remain, clean with #200 emery dust applied with a cloth soaked with gasoline;

NOTE: When cleaning a corroded part, it is not necessary to erase the corrosion pits. Removal of the corrosion products is sufficient.

c) repeat washing with a gas-soaked cloth and dry; [p 633]

d) apply coat of ALG-1 primer containing 5% aluminum powder, with sprayer or brush.

e) dry primer coating at 12-17°C for 24 hours.

f) apply lacquer 170A (10% aluminum powder added) with sprayer or brush, to dried primer-coated surface on outer airframe skin (colorless film). Use lacquer 170A without added aluminum powder on internal parts of airframe (golden color)

g) dry lacquer coat for 36 hours at 12-17°C and for 24 hours at 18-35°C.

12. Use lacquer 170A to coat those areas of skin with cracks in lacquer but no corrosion.

13. The lacquer coat is restored as follows:

a) remove broken lacquer film with a cloth soaked with special SD paint remover;

b) apply one coat of lacquer 170A with sprayer or brush;

c) dry at 12-35°C for 36 hours.

14. Heat-resistant K-1 enamel is used on skin of fuselage tail section from frame 34 (back); the K-1 enamel coat is dried at 12°C or higher for 2-3 hours.

15. Before painting, place aircraft in an area protected from dust [p 634] and wet down ground around the aircraft with water.

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16. To speed up the drying of the oil-base primer and enamel paints, hot-air blowers (80°C) may be used.

17. Do not dry lacquer under hot sun or when there is fog, dew, or a strong wind.

18. Do not apply oil-base enamels to aircraft surfaces if the relative humidity exceeds 80% and if the temperature is below 12°C.

19. The aircraft may not be brought out into rain or fog until 12 hours after the paint has dried.

20. To preserve the protective coatings, do not allow dust to accumulate. Dusting is done periodically with soft, non-scratching brushes.

It is recommended that the entire external aircraft skin be washed at least once a month in the following manner:

a) wash lacquered surfaces with a soap solution (350-400 grams of soap per 10 liters water) and then wash with clean water;

b) wash surfaces protected by an oxide film with clean water.

Washing is done with soft brushes after removing dust.

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Supplement 4 [p 635]

OPERATIONS WHICH MUST BE PERFORMED ON AN AIRCRAFT RECEIVED BY TRANSPOET

The following must be performed on an aircraft delivered by boat or rail.

1. After opening the container and rolling out the components of the aircraft, carefully examine units of the airframe for any damage caused by transport, loading or unloading.

2. Before assembling the aircraft, check for any damage at the joining locations, check to see that there are plugs on tubing disconnections, and that there are no foreign objects in the compartments.

3. Depreserve the aircraft.

4. After assembling the aircraft, check the angles of travel of the ailerons, flaps, speed brakes, rudder and stabilator in accordance with the rigging diagram.

5. Check, and, if necessary, top off the spherical and cylindrical accumulators with commercial nitrogen and fill the system with AMG-10 oil.

6. Using a ground hydraulic pump, cycle the landing gear, flaps and speed brakes 5 times, check the operation of the ailerons, stabilator, pumping station, and their signaling systems.

7. Check the manual and automatic control operation of the compressor bleed valves and their locking system.

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8. Check the operation of the movable cone in the air [p 636] intake.

9. Check the nitrogen pressure in the landing gear shocks, and, if necessary, top them off.

10. Check the operation of flight controls from manual to automatic.

11. Check the sealing of the hydraulic system.

12. Check the manual and automatic wheel braking systems, including the time for wheel braking and release. Check the emergency braking system.

13. Check the cockpit for pressurization.

14. Check the sealing of the air system.

15. Check the operation of the brake parachute system.

16. Before filling the fuel system, drain off residues of fuel and condensates from all the drainage points. After filling the fuel system, bleed off 1-2 liters of fuel from each drainage point to make certain that all the sediment is removed.

Check the operation of the fuel system. Lock the shut-off valve in the open position.

17. Check to see that all the seat and canopy mechanism safety locks are in place.

18. Make certain the fire extinguishing system is in order and check the tank charge.

19. Depreserve the engine in accordance with the instructions on engine operation.

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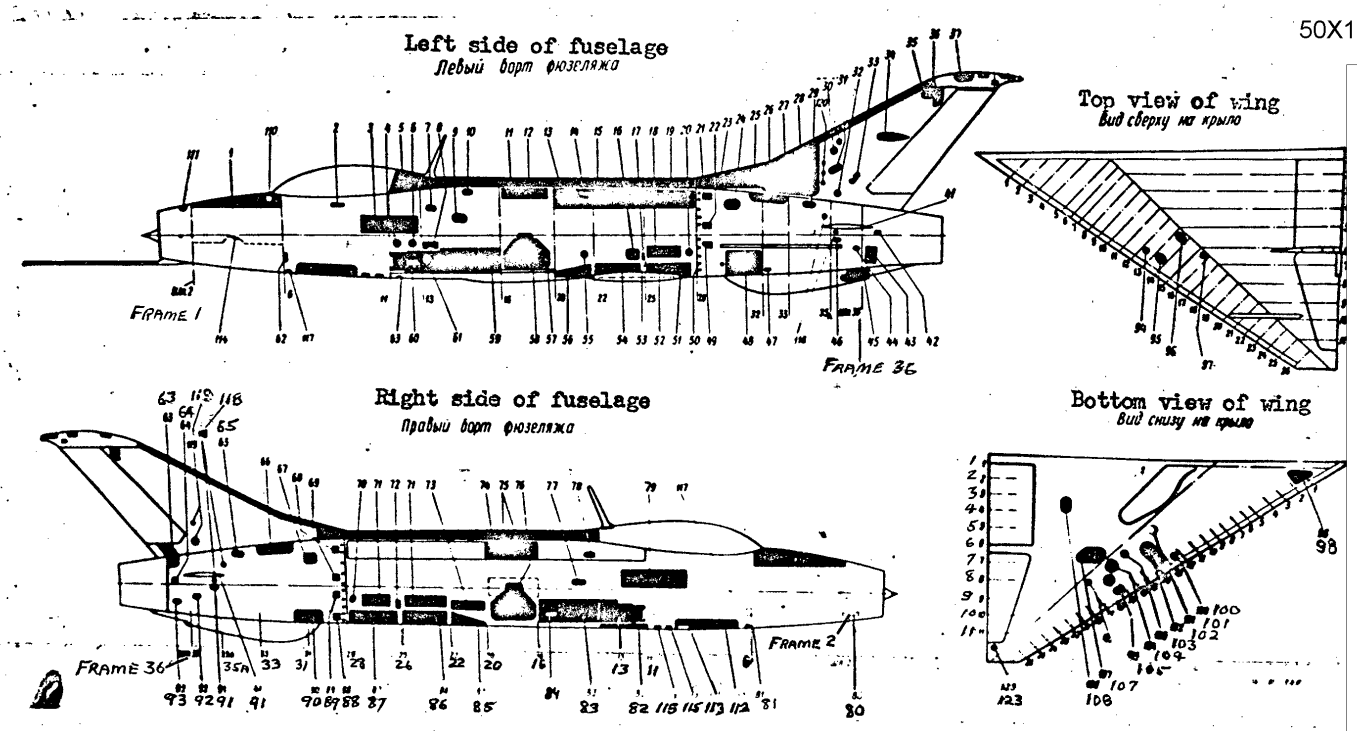


Fig. 135. Diagram showing the location of hatches [and accesses] on the aircraft

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Fig. 135. Diagram showing the location of hatches [and accesses] on the aircraft. [p 638]

1. Radio equipment
2. After opening canopy, install ground safety pin in canopy emergency lever
3, 79. Electrical equipment
4. Access
5. Kerosene system components
6. Oxygen feed reduction valve
7. Inspection hatch
8. Aileron rocking arm
9. Wing tank connector
10. Fuel tank filler
11. Float valve and danger level signaling device
12, 93. Kerosene tank drain and aircraft controls
13. Gasoline [sic] filler
14. Tank filler
15. Kerosene tanks Nos 4, 5, and 6
16, 52, 86, 87. Engine components
17, 72. Engine mounts
18. Engine components and hydraulic systems
19. Kerosene tank drains and controls
20. Booster system pump connection
21. Hydraulic reservoir filler
22. Kerosene line connect
23. ARU-3V [automatic control indicator]
24. Thermocouple
25. Charging mechanism for the ARU-3V
26. Booster system accumulator [p 639]
27. NP-27 pump station. Hydraulic booster and MRP-56P [marker receiver]
28, 35, 36, 37. Mountings for radio leads and slot antenna exciter
29, 41, 65. Stabilator controls
30, 31, 32, 33. Rudder control rocking arms
34. Compass
42, 64. Nozzle [actuator] cylinder
43. Nozzle [actuator] hydraulic tubing
44, 92. Afterburner mounts
45. Brake parachute lock
46, 91. Bearing lubrication
47. Telescoping coupling drain
48. Brake parachute
49, 89. Split hydrovalves
50. Fuselage joint fittings
51. Kerosene drain
53, 71. Engine and hydraulic system components
54. Kerosene drain

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55. Sediment drain
56. Hydraulic and kerosene system components
57. Pump for No 3 kerosene tank, controls
58, 74. No 3 kerosene tank
59. Kerosene system components
60. Kerosene and cockpit-air lines
61, 82. Speed brake attach [p 640]
62, 81. Landing gear strut [pivot] axis
63. Rudder rocking arm
66. Accumulator of main hydraulic system
67. Thermocouple
68. Hydraulic reservoir filler
69. Fuel tank pressure relief valve
70. Main hydraulic system ground pump connection
73. Hydraulic components
75. Attach screws of No 3 kerosene tank
76. Oxygen tank filler
77. Wing tank connection
78. Inspection hatch
80. Emergency tow attach
83. Voltage regulator, KAF-13A turbo-cooler, connector with locking device
84. Hatch
85. Fire extinguisher tank
88. Temperature indicating device
90. EK-48 [electric valve], MRP-56P [marker receiver]
94, 97, 100, 103. Attachments for a special suspension [wing pylon]
95. PUS-36 [rocket fire control mechanism]
96. Landing gear strut [pivot] axis
98. Non-linear mechanism
99. Air bottle
101. Kerosene drain
102. Wing pylon electrical connector
104. Aileron rocking arm
105. Access to navigational lights [p 641]
107. Hydraulic booster
108. Flap actuator cylinder
109. Ground jack location
110. Destruct button
111. Alcohol filler
112. Accumulator [battery?] hatch
113. Battery cell emf control
114. Access to RVU [radio altimeter] units
115. External power connection
117. Access hatch to nose gear units
118, 119. Inspection hatch to rocking arm bolts of controls
120. Access hatch to booster attach bolts
123. Access to aileron shaft

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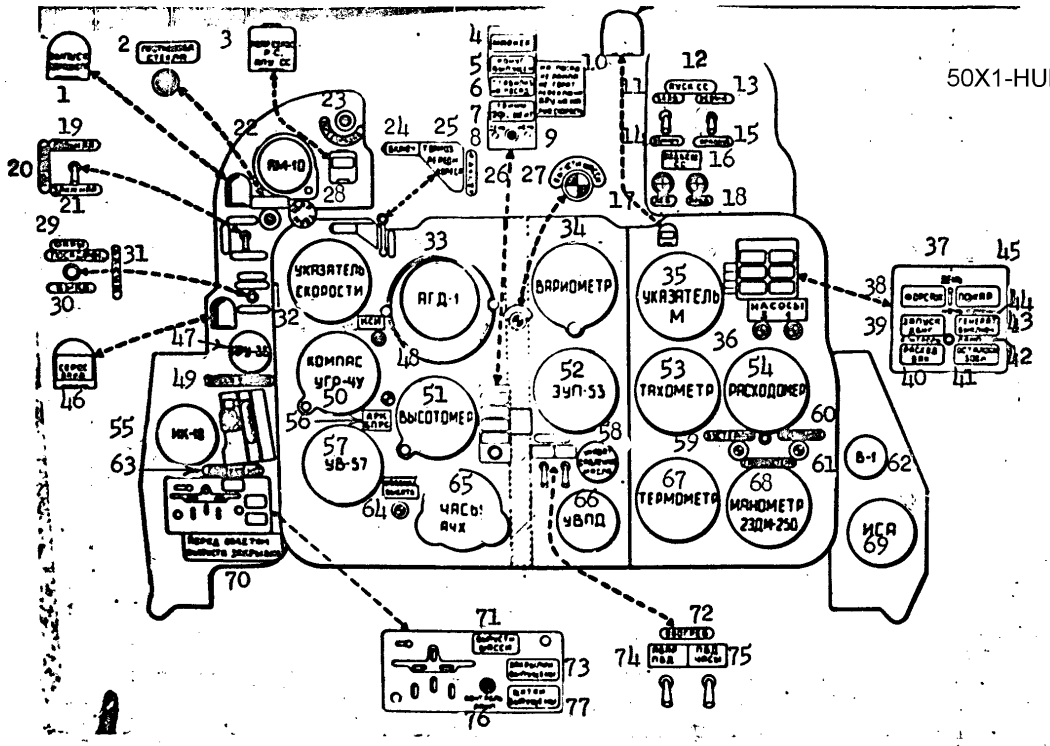


Fig. 136. Location of Instruments on Instrument Panel.

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Fig. 136 Location of Instruments on Instrument Panel [p 642]

1. Parachute release
2. Windshield de-icer
3. Emergency jettison RS [Raketnyye snaryady -- Rockets], APU [Aviatsionnoye puskovoye ustroystvo -- Launch mechanism] an SS [Samonavodyashchiyesya snaryday -- Missiles]
4. Marker
5. Cone extended
6. Stabilization on landing
7. Trim effect neutral
8. Day (left) - night (right)
9. Light is not on during landing. Switch ARU [?Avtomaticheskaya regulirovka upravleniya -- Automatic controller?] to low speed
10. Emergency launch SS
11. Salvo
12. SS launch
13. Left
14. Single
15. Right
16. SS attached
17. Left
18. Right
19. Long range
20. Beacon
21. Short range
22. AM-10 [accelerometer]

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23. Reload
24. On
25. Nose wheel brake
26. Off
27. Extend landing gear
28. Emergency brake
29. Landing lights
30. Off
31. Taxi lights
32. Air speed indicator
33. AGD-1 [Aviagorizont distantsionnyy -- Attitude indicator]
34. Vertical velocity indicator
35. Machmeter
36. Pumps
37. Day
38. Afterburner
39. Engine start
40. Drop tank
41. [Fuel] reserve, 500 liters
42. Monitor light
43. Generator off
44. Night
45. Fire
46. Tank jettison
47. ARU-3V [?Automatic controller indicating device?]

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48. KSI [Kursovaya sistema istrebitelya -- Fighter course indicator system]

49. Landing gear retracted

50. UGR-4 compass [Indicator of course, magnetic bearing, radio station angles, course deviation]

51. Altimeter

52. EUP-53 [Elektricheskiy ukazatel' povorota -- Electric turn indicator]

53. Tachometer

54. Fuel flow indicator

55. IK-18 [Indikator kisloroda -- Oxygen gage]

56. ARK BPRS [Avtomaticheskiy radiokompas -- Automatic radio compass, Blizhnyaya privodnaya radiostantsiya -- Inner marker beacon]

57. UV-57 [Ukazatel' vysoty -- Altitude indicator]

58. Oil pressure gage

59. Booster

60. Utility

61. Hydraulic system

62. V-1 [Voltmeter]

63. [Landing gear] extended

64. Dangerous altitude

65. AChKhO [Aviatsionnyye chasy -- Aircraft clocks] triple-dial clock

66. UVPD [Ukazatel' "vysoty" i perepada davleniya -- Cockpit-altitude and differential-pressure indicator]

67. Temperature gage

68. 2EDM-250 [Elektricheskiy distantsionnyy manometer -- Electrical pressure gage]

69. ISA [Integriruyushchiy schetchik amper-chasov -- Ampere-hour meter]

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70. Extend flaps before take-off

71. Extend landing gear

72. Heat

73. Flaps extended

74. Emergency PVD [Priyemnik vozdushnykh davleniy -- Pitot-static head]

75. Operational PVD and clocks

76. Monitor light

77. Speed brakes extended

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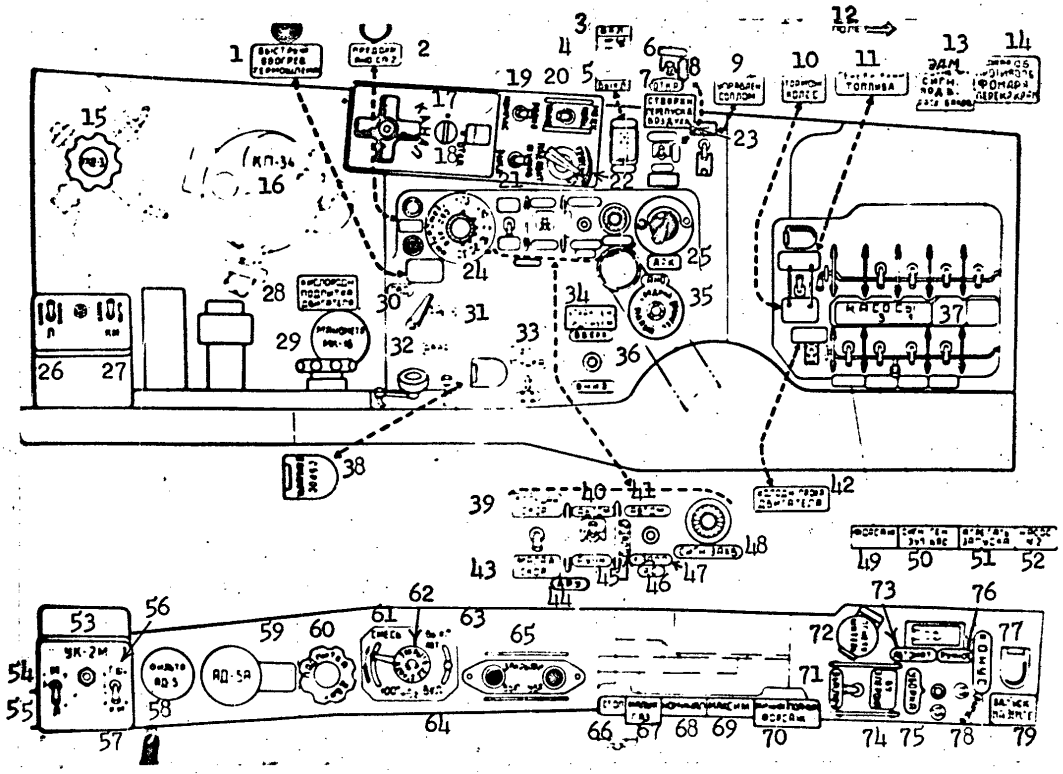


Fig. 137. Left Console Instrument Arrangement.

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Fig. 137 Left Console Instrument Arrangement [p 643]

1. Rapid helmet heating
2. SP-2 ANO [Aeronavigatsionnyye ogni -- Navigational lights] fuse
3. On
4. Air start
5. Off
6. Automatic
7. Open
8. Close
9. Emergency nozzle control
10. Automatic brakes
11. Fuel shut-off valve
12. Forward
13. EDM [Elektricheskiy distantsionnyy manometr -- Electrical pressure gage], drop-tank-attached indicator
14. Canopy de-icing shut-off valve [in case of fire]
15. KKV-3 [?Komplekt kislorodnogo ventilya? -- Oxygen valve unit]
16. KP-34 [Kislorodnyy pribor -- Oxygen apparatus]
17. Channel
18. Open
19. Radio compass
20. Power -- full (left), normal rated (right)
21. Noise suppressor (right), off (left)
22. Volume
23. Air by-pass valves

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24. Helmet heat

25. ARK [Avtomaticheskiy radiokompas -- Automatic radio compass]

26. L [Letnyy kostyum -- Flying suit]

27. KM [Kislorodnaya Maska -- Oxygen mask]

28. Engine oxygen supply

29. MK-16 [Manometr kisloroda -- Oxygen gage] gage

30. PVD [Priyemnik vozdushnogo davleniya -- Pitot-static head]

31. Operational

32. Emergency

33. RS [Raketnyye snaryady -- Rockets], Cannon, SS [Samonavodyayshiysya snaryady -- Missiles]

34. Seat adjust

35. ANO -- bright, medium, dim

36. Up -- down

37. Pumps

38. Parachute jettison

39. High speed

40. Automatic -- manual

41. Automatic

42. Engine cooling blanket(s)

43. Low speed

44. ARU [?Avtomaticheskaya regulirovka upravleniya -- Automatic controller?]

45. 2 salvo

46. RS

47. 1 salvo

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48. Lock-on signal

49. Afterburner

50. Generator, EUP [Electricheskiy ukazatel' povorota -- Electric turn indicator], and KYaS [?] indicator

51. Starting units

52. Pump No 2

53. M [?Manometr -- Gage?]

54. UK-2M [Ustanovka kisloroda -- Oxygen unit]

55. L

56. Gsh [Germoshlem -- helmet]

57. KM

58. AD-5 [Avtomat davleniya -- Automatic pressure control] filter

59. AD-5A

60. Engine [oxygen] supply

61. Mixture

62. Full closed

63. Off - Automatic

64. On

65. Flaps, down (left) -- up (right)

66. [Engine] off

67. Idle

68. Normal rated

69. Maximum

70. Afterburner -- minimum/full

71. Off

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72. Fire extinguisher

73. Automatic

74. Aileron booster

75. Retract

76. Manual

77. Cone

78. Extend

79. Ground start

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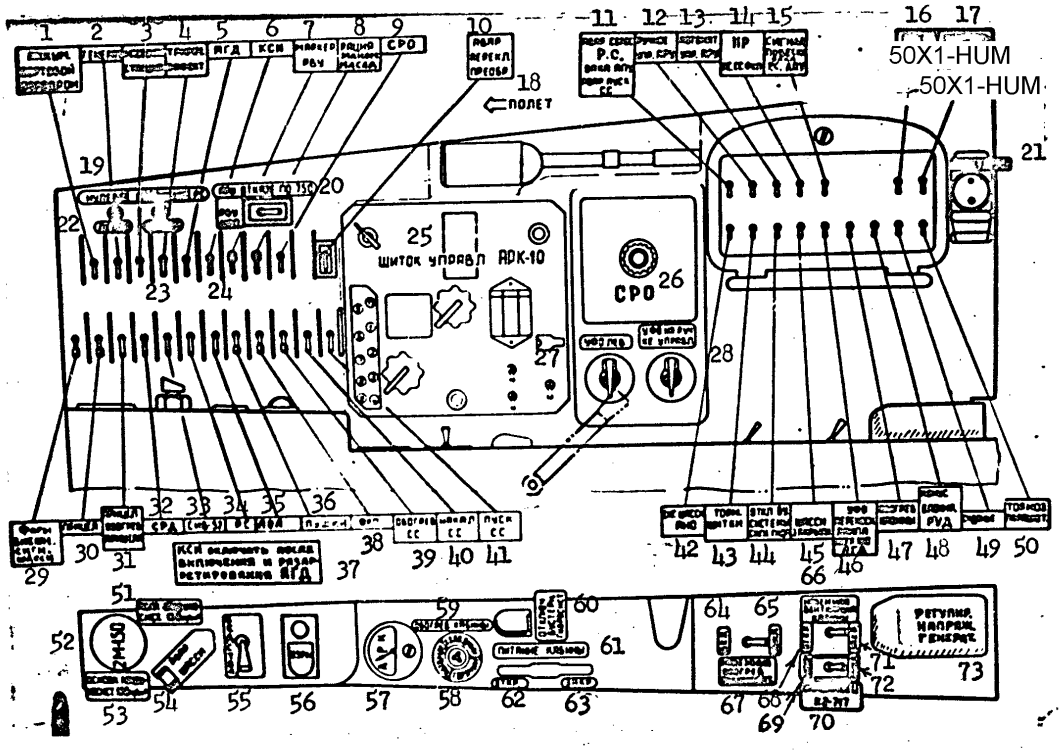


Fig. 138. Right Console Instrument Arrangement.

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Fig. 138 Right Console Instrument Arrangement [p 644]

1. Battery -- aircraft, external
2. Generator
3. Pump unit
4. Trim effect
5. AGD [Aviagorizont distantsionnyy -- Attitude indicator]
6. KSI [Kursovaya sistema istrebitelya-- Fighter course indicating system]
7. RVU [Radiovysometer -- Radio altimeter] marker
8. Oil pressure gage
9. SRO [Stantsiya radiolokatsionnogo otvetchika -- Responder radar]
10. Emergency converter switch
11. Emergency jettison RS[raketnyye snaryady -- rockets], wing tank, APU [Aviatsionnoye puskovoye ustroystvo -- launch mechanism] and emergency launch SS [samonavodyashchiyesya snaryady -- missiles]
12. Manual control ARU [?Avtomaticheskaya regulirovka upravleniya? -- Automatic controller
13. Automatic control ARU
14. NR [NR-30 cannon], RS, SS, and FKR [Fotokinopulemet -- gun camera]
15. Wing tank, RS, APU indicator light
16. ARK [Avtomaticheskiy radiokompas -- automatic radio compass]
17. Light register monitor, fuel reserve, trim effect signal
18. Forward
19. Null position of RS
20. [Switch on] in event of PO-750 converter failure
21. Utility light

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Fig. 138 (cont'd)

22. Left

23. Right

24. RVU MRP [Markernoye radiopriyemnik -- Marker beacon radio receiver]

25. ARK-10 control panel

26. SRO

27. UFO [Ul'trafioletovoye osveshcheniye -- Ultraviolet lighting] left

28. UFO on control stick

29. External landing gear indicator lights

30. Sight

31. Sight warm-up

32. SRD [Stantsiya radiodal'nomera -- range-only radar]

33. SIV-52 [Signalizator infrakrasnogo vizira -- Infrared viewer]

34. RS

35. AFA [Aerofotoapparat -- Aerial camera]

36. Cannon

37. Turn on KSI after switching on and uncaging AGD

38. FKP

39. SS warm-up

40. SS filament

41. SS launch

42. Landing gear and ANO [Aeronavigatsionnyye ogni -- Navigational lights] indicator light

43. Speed brakes

44. Booster system and hydraulic indicator switch

45. Landing gear, flaps

46. UFO, utility light, heating of KKO [Komplekt kislorodnogo oborudovaniya -- Oxygen equipment unit] and AGD

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Fig. 138 (cont'd)

47. Cabin heating

48. Cone-RUD [Ruchnoye upravleniye dvigatelya -- Throttle] interlock gear

49. Seat

50. Parabrake

51. Emergency air system - 130 kg/cm^2

52. 2M-150 [air pressure gage]

53. Utility air system - 130 kg/cm^2

54. Emergency landing gear extension

55. Distress

56. Destruct

57. [Cabin temperature control dial] automatic, hot, cold

58. ARK

59. Cabin heat

60. Hydraulic booster system cut-off

61. Cabin air

62. Open

63. Close

64. On

65. Off

66. Cabin ground ventilation

67. Battery ground heating

68. Open

69. On

70. K2-717 recorder

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71. Close

72. Off

73. Generator voltage regulator

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